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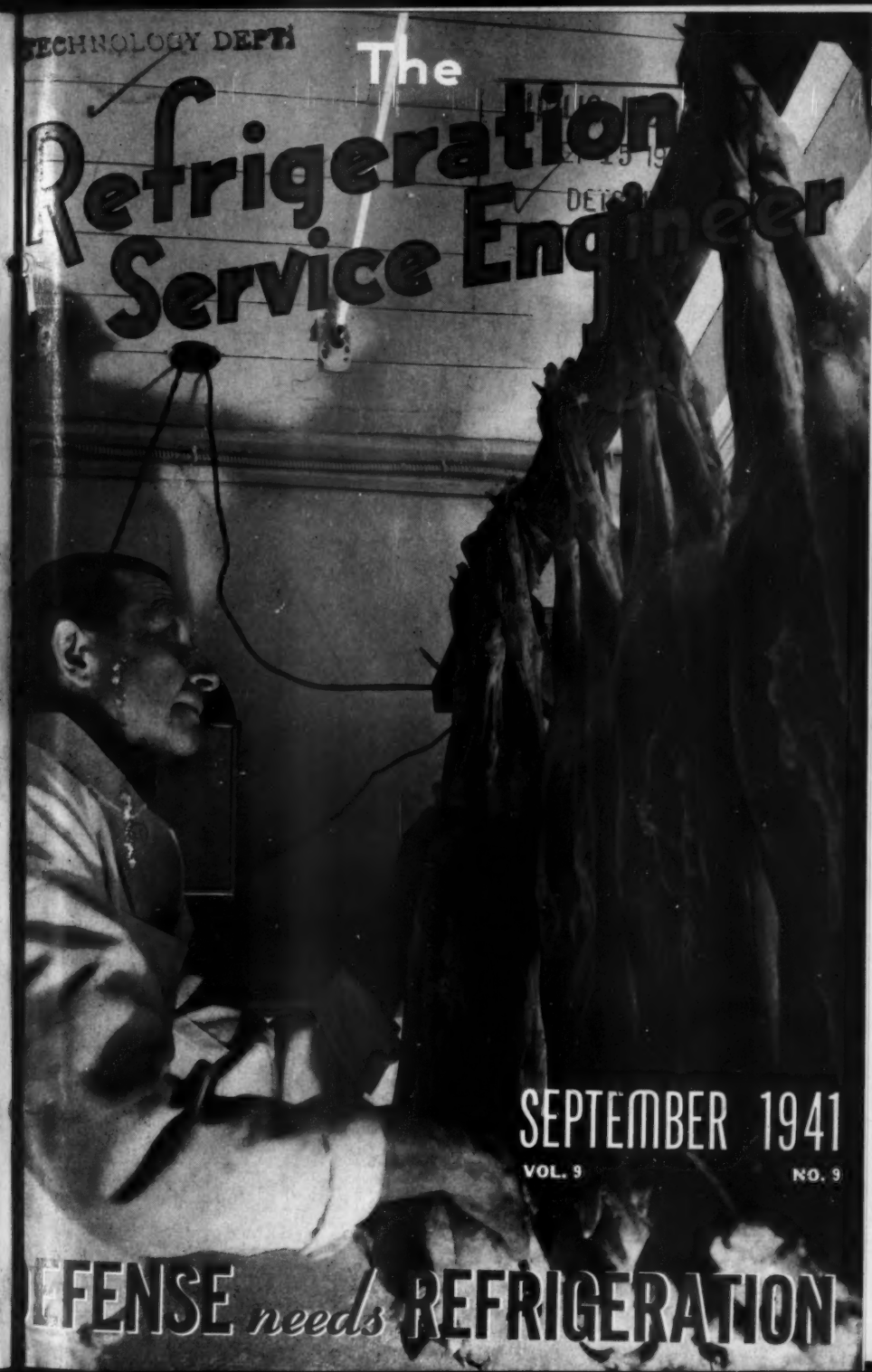
The Refrigeration Service Engineer



SEPTEMBER 1941

VOL. 9 NO. 9

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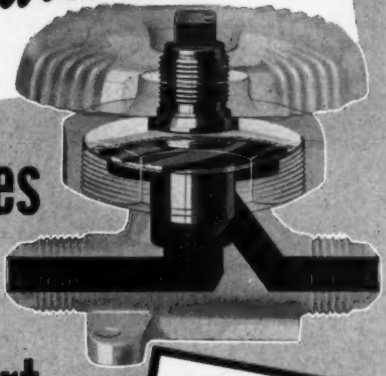

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What Will You Do When the Freon Shortage Strikes You?

Here is a round-up of suggestions, individual instructions and general thoughts on the subject, which will help you meet the situation. Each installation, of course, will require separate consideration, but the information contained herein will aid in determining what can or cannot be done.

THE Kinetic Chemicals, Inc., sole manufacturers of Freon-12, have found it necessary to allocate the available supply of that refrigerant. The most recent information received indicates that this situation will be temporary; however, "temporary" may mean two months, four months, or maybe six months, and in the meantime, what are we going to do? *(See OPACS order on next page.)*

The very first suggestion is that all new installations be made with methyl chloride. If this were done generally, the shortage would be greatly alleviated, because a large percentage of gas 's used on new installations and a relatively small percentage for replacement purposes. You may be compelled to do this in the future anyway, because apparently only sufficient Freon-12 for replacement purposes will be made available.

Many concerns are being forced to consider substitution of methyl chloride or sulphur dioxide for Freon-12 in existing installations, and of course, methyl chloride is preferable because its operating pressures are more nearly comparable to those of Freon-12. When making such changes, present codes and other regulatory laws must be adhered to unless waived by your local authorities, and due regard for safety must be kept in mind.

Most Systems Can Be Changed

Most commercial and household refrigerating systems can be changed to methyl without hazard in regard to safety. Small air conditioning machines containing not more than four pounds of refrigerant can also come under this class. Larger air conditioning systems, however, should not be changed without consulting the manufacturer and all other parties concerned. Other specific reasons why the change should not be made on any type of system will be covered in later paragraphs.

The substitution of methyl chloride or sulphur dioxide for Freon-12 will not ordinarily reduce the efficiency of a machine designed for Freon, but will reduce its capacity. Methyl chloride, again, is preferable because the reduction in capacity will be only five to ten per cent.

Adding Methyl to a Freon System

Small amounts of methyl chloride have been added to Freon systems with apparent success when the system has become slightly short on refrigerant. Temperature and pressure adjustments may have to be made to maintain the desired temperature if the percentage of methyl is too great.

Perfectly dry Freon-12, methyl chloride, or sulphur dioxide, when mixed, have absolutely no chemical reaction, nor is there a chemical reaction between these refrigerants if moisture is present. Any reaction which might occur will be between the individual refrigerants and the moisture in question. The normal amount of moisture present in a system could not do anything to a combination of refrigerants which it could not do to either of the refrigerants if present alone. In other words, if there is sufficient moisture to cause corrosion with methyl chloride, then a sludge will be produced which is characteristic of this particular refrigerant. On the other hand, if sufficient moisture is present to combine with the sulphur dioxide, and thereby produce a sludge, then a sludge characteristic of this particular refrigerant would be found in the system. There is no interaction of the refrigerants.

The principal result of the mixing of refrigerants, provided the machine is dry enough for operation with any one of the single refrigerants alone, comes from a change in the boiling points and pressures of the pure refrigerants. If only a little methyl chloride is added to Freon-12, or vice versa, the result is a mixture which behaves very much like the principal constituent of the mixture. The same thing is true of possible combinations of sulphur dioxide and Freon-12. Mixtures containing more nearly equivalent quantities of two refrigerants deviate to a larger extent, in their characteristics, from either of the pure refrigerants. It is in this zone that highly erratic behavior of a machine containing refrigerant mixture is encountered, due to the fact that the refrigerants separate as a result of a definite distillation process.

Vapor Pressure of F-12—Methyl Chloride Mixtures

The vapor pressures of mixtures of F-12 and methyl chloride, at a given temperature, lie between the vapor pressure of the two refrigerants at this temperature. Thus at 80° F. the vapor pressure of a mixture lies

OPACS Order

Title 32—Nat

Chapter XI—Office of Price Administration

CIVILIAN ALLOCATION PRO HYDROCARBON

THE total defense and civilian demand for certain chlorinated hydrocarbon refrigerants is in excess of the available supply. It is necessary, therefore, after military defense needs are satisfied, to provide for the equitable allocation of the residual supply among competing civilian demands.

Accordingly, pursuant to and under the authority vested in me by Executive Order No. 8734, particularly Section 2 (a) thereof, the following program is announced:

1335.31 *Allocation of Materials.* Civilian uses of those chlorinated hydrocarbon refrigerants enumerated in 1335.32 hereof shall be divided into four classifications as set forth in 1335.33 hereof. To the extent that supplies of these refrigerants are available for allocation among competing civilian demands, supplies for civilian uses enumerated under Classification A shall be given primary preference. If it appears, in any month, that the available supply for that month will exceed the amount estimated to be required for the uses enumerated under Classification A, supplies for civilian uses enumerated under Classification B shall be given secondary preference. If it appears, in any month, that the available supply for that month will exceed the amount estimated to be required for the uses enumerated under Classifications A and B, supplies for civilian uses enumerated under Classification C shall be given tertiary preference. If it appears, in any month, that the available supply for that month will exceed the amount estimated to be required for the uses enumerated under Classifications A, B, and C, the residual supply shall be divided among users enumerated under Classification D. If it appears, in any month, that the available supply for any Classification is less than the existing demand in that Classification, producers of such refrigerants shall allocate the available supply ratably among the users in accordance with the average month consumption by such users during the period July 1, 1940 to June 30, 1941; provided however that the Director of Priorities of the Office of Production Management may, with the concurrence of the Director of Civilian Allocation of the Office of Price Administration and Civilian Supply, grant adjustments

Governing Freon

ional Defense and Civilian Supply Part 1335—Chemicals GRAM FOR CHLORINATED REFRIGERANTS

deemed necessary or appropriate upon the application of any producer or user of such refrigerants complaining of inequity or hardship in the allocation within a Classification.*

1335.32 *Materials Included.* The term "chlorinated hydrocarbon refrigerants" referred to in 1335.31 hereof means: Trichloromonofluoromethane, Dichlorodifluoromethane, Dichloromonofluoromethane, Trichlorotrifluoroethane, Dichlorotetrafluoroethane.*

1335.33 *Classification by Uses.* The Classification referred to in 1335.31 shall be as follows:

Classification A: Maintenance of regrigeration equipment already installed.

Maintenance of air-conditioning equipment already installed in hospitals, clinics and sanatoria.

Classification B: Maintenance of industrial air-conditioning equipment already installed.

Classification C: Maintenance of air-conditioning equipment already installed, not included in Classifications A and B.

Classification D: Manufacture of new refrigeration equipment.

Manufacture of new air-conditioning equipment.

The Preference ratings for chlorinated hydrocarbon refrigerants provided for in this Civilian Allocation Program shall supersede any conflicting preference ratings or specific allocations of chlorinated hydrocarbon refrigerants created under other Civilian Allocation Programs.*

1335.34 *Avoidance of Excessive Inventories.* Preferences granted under this program shall not be used to accumulate excessive inventories.*

1335.35 *Enforcement.* The foregoing program is to be administered and enforced by the Office of Production Management.*

1335.36 *Effective Date and Expiration.* This program shall take effect on August 15, 1941 and shall, unless sooner terminated by the Administrator, expire on December 31, 1941.*

Issued this 15th day of August, 1941.

Leon Henderson, Administrator.

* 1335.31 to 1335.36, inclusive, issued pursuant to the authority contained in Executive Order No. 8734.

between 98.76 pounds per square inch gauge (F-12) and 85.3 pounds per square inch gauge (CH_3Cl), the respective vapor pressures of the two refrigerants.

To get at this value more exactly two means may be employed, namely, calculations based on Raoult's Law, and actual measurements of the pressures of mixtures at various temperatures. Data are not available for the latter, but approximate calculations may be made using Raoult's Law. Raoult's Law may be most briefly stated as

$$P = P_1 x \qquad t = \text{constant}$$

Where P = vapor pressure of one component of a mixture
P_1 = vapor pressure of this pure component
x = mole fraction of component present.

P_1 may be gotten from the pressure table for the refrigerant under consideration, while x may be calculated from the percentage by weight of the components of the mixture. Values for x have been thus calculated and are shown in Table I.

A sample calculation will serve to illustrate the method employed to obtain an approximate value for a 30% by weight mixture of F-12 with methyl chloride at 80° F.

Vapor Pressure F-12 at 80° F. = 98.76 lbs. per square inch absolute.

30% by weight = .15 mole fraction.

$P = P_1 x = 98.76 \times .15 = 14.81$.

Vapor Pressure CH_3Cl at 80° F. = 85.3 lbs. per square inch absolute.

$P = P_1 x = 85.3 \times .85 = 72.5$.

Since each component contributes its own pressure, the total for the mixture is equal to the sum or

14.81 + 72.5 = 87.31 pounds per square inch absolute.

Similar calculations may be made for all desired temperatures and percentage by weight mixtures.

TABLE I—Mole Fraction Values

% by weight F-12	% by weight methyl chloride	Mole fraction F-12	Mole fraction methyl chloride
10	90	.044	.956
25	75	.122	.878
50	50	.293	.707
75	25	.556	.444
90	10	.789	.211

Beware of Anti-Freeze Material

Where methyl chloride or Freon-12 have been treated with methanol, Ice-X, Thawzone, or similar anti-freezes, sulphur dioxide treated cannot be added, due to the fact

that its mixtures with these anti-freezes are corrosive to common metals. This corrosion is very rapid and usually occurs within a day or so. Therefore, in all changeovers to SO_2 from Freon-12 or methyl chloride, beware of anti-freeze materials. If Formex wire is used in hermetic units, then sulphur dioxide cannot be substituted for Freon-12, because SO_2 destroys the insulation.

Mechanics of the Change

General observations on the changing of a system from Freon-12 to another refrigerant can be summed up in the following suggestions:

Quantities of Refrigerant. Each pound of Freon charge may be replaced by: one pound of sulphur dioxide or 2/3 pound of methyl chloride.

Moisture. The quantity of moisture present in a Freon-12 machine, which is operating normally, is so small that the machine need not be dried out, or a drier used, unless moisture is introduced during the operation of changing to methyl chloride. If sulphur dioxide is to be used, dry out thoroughly before recharging.

Oil. In changing from Freon-12 to methyl chloride, the oil, if of proper viscosity for Freon-12 (150-350 second Saybolt) need not be changed where methyl chloride is to be used, provided the oil is in good condition. Check the oil level after the machine has operated for a few hours and adjust if necessary. When a change is made to sulphur dioxide, recharge with an oil recommended for this refrigerant. Viscosity 70-150 seconds Saybolt.

Warning. Occasionally Freon equipment contains aluminum tubing, coils, fittings, or compressor parts. Do not convert such equipment to methyl chloride without eliminating all aluminum parts.

Expansion Valves. The general opinion is that expansion valves designed for Freon-12 may be adjusted for methyl chloride temporarily, but should be replaced for best results.

Special consideration must be given to other types of metering devices, such as capillary tubes, and also units employing flooded evaporators. Consult the manufacturer.

Float Valves. Conversion to sulphur dioxide will not interfere with float valve operation. Conversion to methyl chloride will require adjustment to compensate for the lower density of methyl chloride.

Control Setting. The control setting should be adjusted to correspond to methyl chloride or sulphur dioxide and the temperature desired.

Refrigerant Removal. To remove Freon-12 and leave most of the oil in the machine, close the valve to the condenser and connect a cylinder of proper size to the outlet from the compressor. Place the cylinder in cold water and operate the compressor until all the refrigerant has been transferred to the cylinder; some oil will come over with the Freon-12. Weigh the cylinder before and after the transfer to determine whether its capacity has been exceeded. Better allow an extra 10% margin of safety to allow for some oil content.

Freon-12 may be removed as a liquid by connecting the cylinder (in cold water) to the liquid line from the receiver and operating the compressor, as above, except that the outlet valve of the compressor is left open. Oil remaining in the crankcase may be removed through the oil port, if desired.

Solvents for Flushing. Carbon tetrachloride is becoming scarce. In the absence of this or other chlorinated solvents, gasoline may be used. Motor fuels containing lead should be avoided for this purpose. Poisoning may result.

Compressor. If the machine is of ample capacity, no change in compressor speed may be necessary. Excessively long cycling may be corrected by increasing compressor speed. Ten per cent speed increase by changing the pulley is usually adequate for a change to methyl chloride. In some cases more will be needed—maximum 20% increase.

Thermostatic Expansion Valves

In consulting the manufacturers of expansion valves on the question of whether or not the Freon valve could be used on a methyl chloride system the following replies were received:

Spoehrer-Lange Co.—While in some cases the Freon valves may work, it is not recommended in the majority of cases. There are several factors which must be taken into consideration in expansion valves. To begin with, a valve for a Freon installation will have a bulb pressure of approximately ten pounds per square inch greater than that of a valve for a methyl chloride job. While on some small jobs this difference in pressure can be compensated for through the adjusting stem, it is not a good practice and the valve performance will be very erratic.

Perhaps of greater importance is the orifice of the valve. For example, a ¼ inch

port valve for Freon is rated at six tons with a sixty pound pressure drop across the valve, while this same size orifice valve is rated at twelve tons on methyl chloride with the same pressure drop. This difference in capacity cannot be adjusted by the stem.

It is recommended that the expansion valves be either replaced or returned to the factory for conversion to methyl chloride.

Detroit Lubricator Co. valves always perform more satisfactory when the charge in the power element is identical with that in the system.

Assuming, however, all Freon valves in the field to be set for 10° superheat at 32° bulb, the adjustments as indicated will allow these same valves to operate on methyl chloride, the superheat being approximately 10° at 32° bulb for operation between 40° F. and and 15° F., and approximately 10° superheat at 0° bulb for operation below 15° F.

Detroit Valve Adjustments

Valve No.	Operation 40° to 15° No. Turns	Operation Below 15° No. Turns	Direction
893	2¾	½	Clockwise
897	2¾	½	Clockwise
673	1½	1	Counter
679	3	1¼	Clockwise
781	2½	1¼	Clockwise
783	2½	1¼	Clockwise
785	5¼	3½	Clockwise
786	3½	¾	Clockwise
787	3½	¾	Clockwise
788	7	1¼	Clockwise

Because the general construction of Freon valves differs from sulphur valves, it is not recommended that these be used on any systems with sulphur dioxide.

Fedders Mfg. Co.—It has been the practice in the industry to build thermostatic expansion valves to correspond to the respective refrigerants that would be used with them in order to obtain the most efficient type of valve operation. Further, a valve equipped with a .045 inch orifice needle-seat has a capacity of approximately .4 tons when used on a Freon system, and the same valve with the same size orifice needle-seat, when used on a methyl chloride system has a capacity of .85 tons. Therefore the necessity for having the valves designed for the refrigerant they will be used with.

Alco Valve Co.—A thermo valve charged with F12 and set for ten degrees (10°) superheat for a given evaporator temperature, will operate at one degree (1°) superheat if the system charge is converted to methyl chloride and if the superheat adjustment is not changed. Similiarly, a valve set for fifteen degrees (15°) superheat on a Freon system will operate at seven degrees (7°) superheat when the charge in the system is converted to methyl chloride. In other words, the number of degrees change in superheat resulting from the system charge being converted from Freon 12 to methyl chloride is nearly constant over the range of the evaporator temperatures normally encountered in commercial refrigeration and air conditioning practice, providing that the same evaporator temperature is used before and after the conversion.

Alco T Series single-outlet and multi-outlet thermo valves have a maximum Freon 12 superheat setting of twenty-seven (27°) with a thirty-two (32°) bulb temperature. When used on a mythyl chloride charged system, and the superheat adjustment is turned all the way in to provide the maximum superheat, the following table shows the maximum superheat setting obtainable for various evaporator temperatures.

Alco Valve Adjustment Data

Evaporator Temperature	Maximum Superheat Setting Available with F12 Valve on Methyl Chloride System
20° F.	15°
30° F	12°
40° F	10°

After the system has been converted from Freon to methyl chloride, it is suggested that the following steps be taken:

1. Turn the superheat setting adjustment all the way "in" for the maximum superheat setting. This change should suffice for all valves on systems that have the valve properly sized to the load.
2. If the valve should "hunt" or "flood through" after the above adjustment is made, a smaller capacity valve must be used. In the case of Alco Valves this may easily be done by changing cages in most cases.

On the small commercial refrigeration valves, satisfactory operation may be obtained in most cases by merely increasing the superheat adjustment. If the increased superheat setting does not result in satisfactory control, the only remedy is to replace the valve with one of proper capacity of the methyl chloride type.

Automatic Products Co.—It would be possible to adjust the expansion valves in the field from Freon to methyl, but it is not recommended, because they should be re-

calibrated and the nameplate changed in order to do the job right.

Customers are being informed that the company will do this job at the factory, if they will return the valves, for fifty cents each, plus freight both ways. The factory will change the spring and nameplate, and recalibrate the valve so it will be as good as a correctly manufactured Freon valve.

SPECIFIC INSTRUCTIONS FROM MANUFACTURERS OF UNITS

In obtaining authentic information on each of the commercial machines, manufacturers of condensing units were consulted. Here is a summary of their recommendations.

Servel, Inc. During the present emergency caused by the very acute shortage of Freon-12, there will doubtless be many machines designed for Freon-12 that will be converted over to the use of methyl chloride. Fortunately, Servel, being the original manufacturers of methyl chloride machines, has continued to manufacture them parallel with machines for Freon-12, and furthermore has made the two types of machines almost entirely interchangeable except for the Supermetics, hermetically sealed commercial machine units, in which only Freon-12 must be used.

All belt-driven machines manufactured for use with Freon-12 may be changed to methyl chloride with entirely satisfactory results. However, there will be some reduction in capacity at the same compressor r.p.m. as the motor pulleys used on Freon machines are approximately 10% smaller in diameter than a corresponding machine for methyl chloride. If it is necessary to maintain the same capacity, the larger motor pulley should be substituted when changing from Freon-12 to methyl chloride.

If the changeover is on an installation using thermostatic expansion valves, the Freon valves should be replaced with methyl chloride valves, although on certain types of installations, particularly air conditioning, where the operating suction pressure is fairly constant, the Freon-12 valve can be used, at least in an emergency.

The type of evaporator for use with Freon-12 is frequently somewhat different from one for methyl chloride. Fortunately, however, it is a much more simple matter to use methyl chloride in a Freon-12 evaporator than it would be to use Freon-12 in a methyl chloride evaporator. On ordinary serpentine coils no difficulty should be experienced on the changeover in so far as the coil design is concerned.

At the same evaporator temperature, the suction pressure with methyl chloride as the refrigeration is, of course, somewhat lower than with Freon-12. Consequently, the pressure control setting must be changed accordingly. The new settings may be determined by reference to the pressure-temperature tables of Freon-12 and methyl chloride. For example, on a self-defrosting cycle with gravity-type finned coil, the cut-in setting of the pressure control should be approximately 25 or 26 pounds per square inch for methyl chloride, instead of the 33 to 35 pounds for Freon-12. A cut-out pressure of the pressure control may be arrived at from the pressure temperature tables or set at whatever pressure may be required to obtain the desired average fixture temperature.

The factory setting of the high pressure cut-out on Servel water-cooled machines is 165 pounds open and 125 pounds closed. This setting may be used on either Freon-12 or methyl chloride.

Adjust Water Valves

The water control valves on Servel water-cooled machines are the pressure-actuated type; therefore, they must be readjusted for the lowered condensing pressures for methyl chloride; otherwise, the capacity of the machine will be considerably reduced by the attempt of the water valve to maintain condensing pressures of Freon-12. If there is plenty of cool condensing water available at comparatively low cost, it is suggested that the condensing pressure of the changed-over installation be carried comparatively low—for example, around 95 to 100 pounds, as this will tend to offset considerably the loss in capacity when changing from Freon-12 to methyl chloride at the same displacement.

It has been the experience that Freon-12 carries a much greater percentage of oil in solution than does methyl chloride, and in making a changeover, care should be taken particularly on low temperature applications that there is not an excess of oil in the system changed over to methyl chloride. If there is, it will considerably affect the heat transmission factor in the evaporator, and will, of course, also affect the operating characteristics of the compressor, and may result in a pounding noise of the compressor. On a Freon-12 to methyl chloride changeover, the oil level in the compressor should be checked daily for at least two or three days, and any excess oil in the compressor should be withdrawn down to the

normal operating level (at the underside of the main bearing or one-quarter inch below this point). On Servel compressors having an oil sight gauge in the crankcase, the normal operating level should be in the lower half of the gauge glass.

Methyl chloride, under certain rather limited conditions, is flammable, and the service engineer should bear this in mind in making the changeover. Moreover, Freon-12 should not be discharged into spaces in which there are open flames present. In view of the extreme scarcity of Freon-12, any of this refrigerant removed from an installation should be saved in a cylinder. Care also should be taken when purging a refrigerant from a water-cooled condenser, as it is quite possible to freeze the water in the condenser and burst the walls of the tubing.

The service engineer who has had only Freon-12 experience should be reminded that he cannot with entire impunity expose himself to large quantities of methyl chloride in the atmosphere. The toxicity of methyl chloride has perhaps been generally and considerably over-emphasized, but it is true that breathing large quantities of it produces nausea and a condition similar to ordinary alcoholic intoxication.

In addition to changing over a system entirely from Freon-12 to methyl chloride, that is, withdrawing the Freon-12 and substituting methyl chloride, it appears that there will be many instances where the service engineer will find it desirable to simply add a small amount of methyl chloride to a Freon-12 system to compensate for a leak that has perhaps allowed only a small percentage of the total charge to escape. Most certainly, under normal conditions, the practice of mixing any refrigerants would be severely criticized, but under present conditions could perhaps be justified.

Modern Equipment Corporation compressors were originally designed for Freon, with methyl chloride as an optional refrigerant. The only change necessary in the product in order to secure maximum efficiency is to change the motor pulley to increase the speed approximately ten per cent. There are no changes in oil charge, as a triple-refined water-white oil that is suitable for both Freon and methyl chloride is used. Recharging from Freon to methyl can be done without a change of motor pulley. In such cases, the only disadvantage is the fact that the B.t.u. capacity would be reduced approximately four per cent.

Brunner Manufacturing Company. Pumping down the system is not advisable because a lot of oil is likely to be pumped out of the machine and will collect in the liquid receiver and be hard to remove. Instead, it is suggested that all oil be drained out of the crankcase. Then, using an external evacuating pump, remove all gas from the equipment which can be discharged into a drum and saved, if desired. At least a 28-inch or 29-inch vacuum should be drawn on the system and held sufficiently long to make certain that all gas has been withdrawn.

If there are any driers or strainers in the system, it would be advisable to remove these and clean them thoroughly. The driers should be replaced with new drier material.

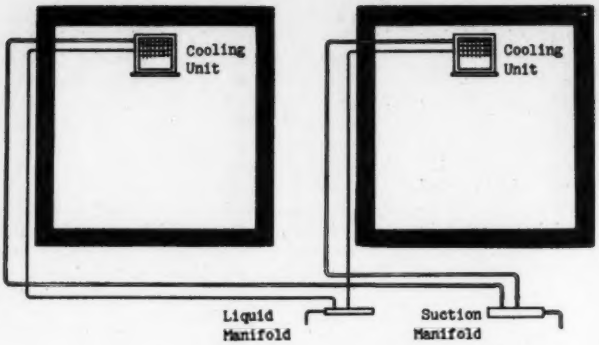
Recharge the compressor crankcase with a fresh supply of refrigerant oil suitable for methyl chloride. Recharge with methyl chloride, remembering that Freon-12 is about 35% to 40% heavier than methyl, and that, therefore, if the system is originally charged with 8 pounds of Freon-12, there need be added only approximately 5 pounds of methyl in order to occupy the same volume.

It is possible to increase the compressor speed about 5% to 10% when using methyl in place of Freon-12. It may not be necessary to make the pulley change because sufficient capacity may be available to do the work, but if there is need for additional capacity when the changeover is made, then the motor pulley can be increased in the percentage indicated. It is also to be realized that even though the motor is loaded to the same number of watts on both Freon-12 and methyl chloride, the methyl machine will not deliver quite the same capacity as the Freon-12 machine. Those installations which have been made and are just being taken care of with a Freon machine may be completely at a disadvantage when changed over to methyl. Those which have ample capacity at present can be changed to methyl without capacity deficiency.

Frigidaire Division. The Frigidaire Division has issued to its field organization definite instructions that under no circumstances should any equipment operating with Freon-12 refrigerant be changed to SO_2, methyl chloride, or any other refrigerant.

Westinghouse Electric & Manufacturing Company have sent a letter to all contractors and distributors handling their equipment, definitely advising against the use of methyl chloride in any Westinghouse air con-

(Continued on page 47)



The simple multiplexed system controlled only by a pressure switch. The operating characteristics of such a system are comparable to a single unit system, but the control of temperature ordinarily is unsatisfactory, particularly where the service or load factor of one refrigerator may vary over that of the other.

Observation ... Multiplexing Compared with ...

By J. H... LIOTT*

The data presented in this paper was found after observations of the operation of many thermostat-solenoid multiplexed installations, which showed that the operating time and power costs were increased over the standard pressure control multiplexed installations. The actual increase obtained from these installations average very closely to the amount shown in the Tables included herein.—Author.

THE heart of any refrigeration system is the temperature control apparatus but unfortunately in the past, multiplexed commercial and industrial refrigeration systems have not had completely satisfactory control of temperatures under all conditions. At best, the single pressure control arrangement for a multiplexed system is a compromise, and, although the temperatures of the various refrigerators may approach complete satisfaction at any one time, at all other times when the ambient temperature and service conditions change, the temperature in all refrigerators cannot be completely satisfactory.

There has recently been a trend toward better temperature control apparatus, following one or the other of two methods, namely: (1) Use of individual condensing units on each refrigerator, (2) Use of various thermostat-solenoid combinations.

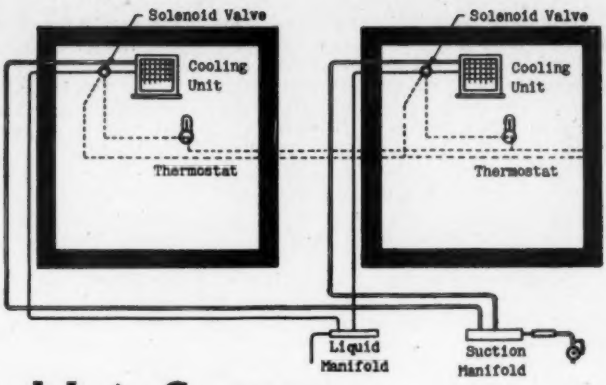
The use of individual condensing units for each refrigerator is ordinarily the more expensive arrangement of the two, but presents no new problems to the service engineer. The thermostat-solenoid combinations do, however, present many new problems for the service engineer's consideration. This article will discuss these problems of the thermostat-solenoid combinations.

Percent Operating Time

Consider for example, two refrigerators operating with 20° F. evaporating temperature refrigerant in the coils connected to one condensing unit, and each refrigerator provided with a thermostat-solenoid combination, and with constant pressure throttling two-temperature valves installed in the suction line leading from each refrigerator to prevent the refrigerant evaporating temperature from dropping below 20° F. regardless of the pressure at the condensing unit.

If each refrigerator must operate 50% of the time to obtain satisfactory temperatures the mathematical science of probability tells us that on an average the condensing unit will operate only 25% of the time on both refrigerators at one time, 50% of the time on one or the other of the two refrigerators but not both, and will turn off 25% of the time. Note that with the thermostat-solenoid combinations the operating time of the

* C. Schmidt Co., Cincinnati, Ohio.



A multiplexed system employing a solenoid-thermostat combination for the control of temperature, with a pressure regulating valve to control pressures in the evaporators. Temperature and humidity control in this system is comparable to the single unit system, but the operating conditions are such that electric costs are much higher.

...ions On ...with Single Unit Systems

By J. H...LIOTT*

condensing unit increases from 50% for the simple pressure control arrangement to 75% for the thermostat-solenoid combinations.

If one of the two refrigerators in this example has a total heat load of say 5,000 B.t.u. per hour and the other of the two refrigerators also has a total heat load of say 5,000 B.t.u. per hour, the condensing unit must develop a capacity of 20,000 B.t.u. per hour for 50% operating time when both refrigerators operate together on the one condensing unit.

As shown above, however, both refrigerators operate together on the condensing unit only 25% of the time, and that for an additional 50% of the operating time one or the other refrigerator operates individually and independently of the other on the condensing unit, thus during 50% of the time the condensing unit develops only 10,000 B.t.u. per hour capacity because it operates on only one of the two refrigerators but not on both together.

Fluctuating Pressures Result

Now the only way that a constant displacement condensing unit can reduce its capacity is by reducing the back pressure of the system. In our example the capacity of the condensing unit automatically adjusts itself to a 10,000 B.t.u. per hour capacity by reducing the back pressure at the condensing unit. Remember that although the back pressure at the condensing unit reduces, the pressure at the coils, and consequently the temperature of the refrigerant in the coils, still remains at 20° F. because of the constant pressure throttling valves.

From our example the following facts are derived, which we can further discuss: (1) Condensing unit operation time increases from 50% to 75% because the back pressure at the condensing unit decreases. (2) The back pressure at the condensing unit decreases because for 50% of the time, only one of the two refrigerators is being refrigerated.

Valves Control Humidity

Many thermostat-solenoid combination multiplexed installations are made without the use of constant pressure throttling two-temperature valve and such installations operate very satisfactorily as long as there is no dehydration problem. If, however, food products that may dehydrate are refrigerated it is very necessary to prevent the back pressure at the coils from dropping below a predetermined setting. Perhaps the best method of doing this is by using the constant pressure two-temperature throttling valves.

If these valves, or some similar arrangement are not used, and since the 20,000 B.t.u. per hour condensing unit in our example operates a greater part of the time on only one of the two refrigerators with a 5,000 B.t.u. per hour load, the coils operate much colder than they were designed for and dehydration results.

Omitting the constant pressure two-temperature throttling valves has the advantage of less initial cost and less operation time of the condensing unit (instead of 75% in our example the operation time of the condensing unit without these valves probably is about 62½%), but the results from a dehydration standpoint cannot be satisfactory. Further discussion will, therefore, assure the use of the constant pressure two-temperature throttling valves in the suction lines leading from each refrigerator.

The question will arise in the minds of many readers about the necessity of using a larger condensing unit because of the increased running time. In other words, if in our example, the condensing unit were designed to operate with a simple pressure control 50% of the time, and then when thermostat-solenoid combinations are used this running time increases to 75%, what would happen to the running time if the condensing unit were originally calculated for a simple pressure control arrangement to operate 66⅔% of the time instead of 50%?

TABLE 1—RUNNING TIME IN PERCENT FOR TWO REFRIGERATORS MULTIPLEXED ON ONE CONDENSING UNIT.

WITH SIMPLE PRESSURE CONTROL	WITH THERMOSTAT-SOLENOID COMBINATIONS
13.5%	25%
29%	50%
33⅓%	56%
42%	66⅔%
50%	75%
66⅔%	89%
100%	100%

To show these various data Table 1 is referred to. Note that from the original 66⅔% the condensing unit running time increases to 89%.

Fortunately, however. although the condensing unit operating time increases from 66⅔% to 89%, each of the two refrigerators is only refrigerated 66⅔% of the time. This means that each thermostat is closed (solenoid open) 66⅔% of the time although the condensing unit is operating 89% of the time.

Observe from Table 1 that as the running time of each individual refrigerator (running time of the condensing unit with simple pressure control) increases, it approaches more closely the total running time of the condensing unit but that the two are not the same until both running times become 100%.

Conclusions are made, therefore, that it is not necessary for good refrigeration to increase the size of the condensing unit when thermostat-solenoid combinations are used even though the condensing unit does run more.

Exception is made when a customer demands that under maximum conditions that the condensing unit operates only, say, 66⅔% of the time. Under such conditions Table 1 shows that the condensing unit must then be chosen in the regular manner for a running time of only 42% (condensing unit capacity at 42% running time must equal combined total head loads of the two refrigerators) when the simple pressure control is used and then when the thermostat-solenoid are applied the running time of the condensing unit automatically increases to 66⅔%.

Fortunately today, most customers are interested only in good results, and as long as these results are obtained, the customers are not interested particularly in running times unless, because of such excessive running time, the operation cost increases unnecessarily. The probable increase in operating cost is of major importance and will be carefully analyzed.

Operating Cost Increases

All refrigeration men know that if everything else being equal, a condensing unit were required to remove heat at a lower back pressure, the operating cost of the condensing unit would be more per unit of heat removed than if the back pressure at the condensing unit were higher. Again considering the conclusions drawn from our example, it is noted that the second one obtained is listed thus, "Condensing unit operation time increases because the back pressure at the condensing unit decreases." It is, therefore, apparent that the operating cost will be greater with the thermostat-solenoid combinations than with the simple pressure control arrangement because the same refrigeration capacity is produced at a lower back pressure.

If reference is made to condensing unit manufacturers tables it is determined that for electric power at 3.5 cents per KWH, a 1 hp. air cooled condensing unit, operating 50% of the time with a simple pressure control, on an evaporating temperature of 20° F. in an 80° F. room, costs about $18.10 per month where electric current costs 3.5 cents per KWH.

With the thermostat-solenoid combinations, however, the same condensing unit operates only 25% of the time at a pressure corresponding to a 20° F. evaporating tem-

perature and 50% of the time at a greatly reduced back pressure so that the capacity of the condensing unit for 50% of the time is only half of the capacity at a 20° F. evaporating temperature. Under these conditions this same condensing unit for the same refrigeration capacity will cost $21.80 per month, or about 20% increase.

A 50% running time of the condensing unit per day for a month with simple pressure control operation ordinarily is obtained only during the hottest three months of the year. For the coldest months of the year, if the average running time for a single pressure control unit is 33⅓% of the time, and with 65° F. air entering condenser, the increase in electric power cost when the thermostat-solenoid combinations are used is about 28% instead of about 20% listed above for the hottest months.

The average electric power cost for the entire year is, therefore, about 24% higher for the thermostat-solenoid combinations,

TABLE 2—PROBABLE ELECTRIC POWER OPERATING COST IN DOLLARS PER MONTH FOR TWO REFRIGERATORS MULTIPLEXED ON A 1 H.P. CONDENSING UNIT. ELECTRIC POWER 3.5 CENTS /KWH.

1 With Simple Pressure Control		2 With Thermostat-Solenoid Combinations		Percent Increase 2 over 1
Summer mos.	$18.10	Summer mos.	$21.80	20%
Winter mos.	11.20	Winter mos.	14.40	28%

compared with the simple pressure control electric power cost when two refrigerators are multiplexed. Table 2 shows these figures.

This article has discussed so far only the multiplexing of two refrigerators with one condensing unit. The use of three refrigerators multiplexed with one condensing unit increases our troubles.

If we again consider our example, but with three refrigerators instead of two, we find that the condensing unit running time increases from 50% with the simple pressure control to 87.5% for the thermostat-solenoid combinations. The 87.5% condensing unit running time is made up of 12.5% condensing unit running time when all three refrigerators operate together, and 75%, condensing unit running time when only one or two of the refrigerators, but not all three, operate on the condensing unit. See Table 3 for condensing unit operation times when three refrigerators are multiplexed to one condensing unit.

Table 4 shows that for summer conditions the electric power operation cost increase of the thermostat-solenoid combinations is about 23% and for winter conditions 36%. This makes the yearly average about 29.5% more for the thermostat-solenoid combinations than for the simple pressure control arrangement.

TABLE 3—RUNNING TIME IN PERCENT FOR THREE REFRIGERATORS MULTIPLEXED ON ONE CONDENSING UNIT.

With Simple Pressure Control	With Thermostat-Solenoid Combinations
9%	25%
21%	50%
31%	66⅔%
33⅓%	71%
50%	87.5%
66⅔%	97%
100%	100%

Although figures are not obtained for multiplexed installations of more than three refrigerators on one condensing unit, the tendency is toward even longer running times and higher operation costs.

In conclusion we can sum up the facts obtained, thus:

1. Thermostat-solenoid combinations give better temperature control than simple pressure control for multiplexed installations.

2. To prevent the coil temperature from becoming too low, thus causing dehydration, when the large condensing unit operates only on a small coil, constant pressure two-temperature throttling valves should be used in the suction lines leading from each refrigerator.

3. Thermostat-solenoid combinations increase the condensing unit running time over simple pressure control, but it should not be necessary to use a larger condensing unit because of the increased running time unless the customer objects to long running times.

TABLE 4—PROBABLE ELECTRIC POWER OPERATING COST IN DOLLARS PER MONTH FOR THREE REFRIGERATORS MULTIPLEXED ON A 2 H.P. CONDENSING UNIT. ELECTRIC POWER 3.5 CENTS /KWH.

1 With Simple Pressure Control		2 With Thermostat-Solenoid Combinations		Percent Increase 2 over 1
Summer mos.	$31.50	Summer mos.	$38.80	23%
Winter mos.	19.20	Winter mos.	26.13	36%

4. The increased running time with thermostat-solenoid combinations causes the operation cost of the condensing unit to be higher.

5. The increase in selling price of the refrigeration equipment installed and serviced with the thermostat-solenoid com-

binations is about 20% to 25% greater than with simple pressure control, but 0% to 10% less than when two condensing units instead of one are used.

6. The greater the number of refrigerators multiplexed on one condensing unit the greater the increase in running time and operating cost.

7. Individual smaller condensing units for each refrigerator of several refrigerators instead of multiplexing with thermostat-solenoid combinations on one larger condensing unit, are better practice when all factors of running time, initial cost, and operating cost are considered. If, however, it is necessary to use the thermostat-solenoid combinations in preference to the individual condensing units, do not place more than two refrigerators on one condensing unit.

The Mechanics of Rebuilding Commercial Compressors

(Continued from the August issue)

By H. D. BUSBY, *Associate Editor*

Aligning Connecting Rods

THE importance of accurately aligning connecting rods cannot be over-emphasized. Rods that are distorted or bent even to a slight extent will cause a knock, or piston slap, and excessive wear on piston and rings. Before installing a rod, no matter for what reason it has been dismantled, and even when no work has been done on the rod, always check it for alignment. Many puzzling knocks and noises are due to misalignment, and quiet operation is always one of the chief objectives in rebuilding compressors. There are three alignments to check: (1) twist in rod, (2) piston pin not parallel with crankshaft and (3) piston pin boss not central with crank bearing.

All of these tests can be made by inserting a rod about eight inches long and of the same diameter as the piston pin into the piston pin hole of the rod. The test rod should fit snugly in the pin hole. A piece of shaft about eight inches long and the same diameter as the crankshaft should be inserted in the bearing end of the rod, and the bearing tightened on it.

Twisted Rod

To check the rod for twist, lay the rod with the test bars mounted in it between the runways of a lathe, or if no lathe is available, lay it on a flat surface such as a piece of plate glass or plate steel. Use four blocks of metal of equal heights, placing one under

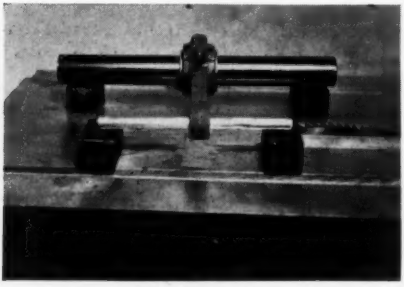


Fig. 7. Testing the rod for twist on the bed of a circular saw. The test bars should rest evenly on all four blocks.

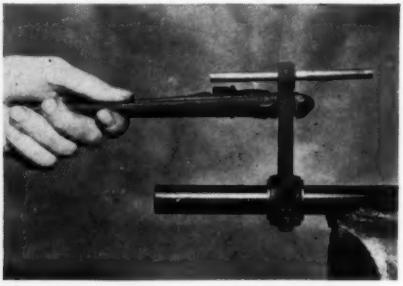


Fig. 8. Using a 12-inch wrench to twist the rod back into line. Note that the wrench is placed near the end of the rod

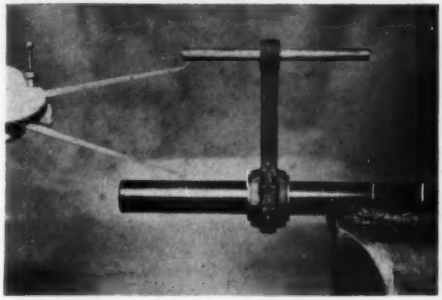


Fig. 9. Making a parallel test. Measurement is taken at both sides of the rod and the rod straightened, as in Fig. 10 at the right, until the measurements are equal.

each end of the two test bars as shown in Fig. 7. These blocks must be high enough to raise the rod off the flat surface. Try rocking the rod and test assembly to see if it rests on the blocks on all corners. If it does not rest on one block, the rod is twisted.

To straighten the twist, grip the larger of the two test bars in a vise and twist the upper end of the rod with a wrench as in Fig. 8. Place pieces of wood or soft copper between the jaws of the vise and the test bar to avoid marring the surface of the test bar. Repeat the testing and twisting until the ends of the test bars rest evenly on all four blocks and no rocking is noticed.

Paralleling Piston Pin with Crankshaft

To determine when the piston pin is parallel with the crankshaft, compare with a pair of calipers the distance between the large test bar and the smaller one, as shown in Fig. 9, first on one side, then on the other. If there is a difference in the distances, the rod is not parallel. For the greatest accuracy, measurements should be taken near the ends of the test bars.

To straighten the rod, place it in a vise as shown in Fig. 10 or lay it on a flat surface with the test bars removed. Place blocks at each end under the rod near the bearing bosses, then strike the rod in the center with a hammer. Repeat the entire operation until the distance between the test bars at each side of the rod is equal.

Centering Pin End with Crank Bearing

To determine whether or not the piston pin boss is central with the crank bearing, hold the rod and its test bars in a vise, then put the base of a square on the larger test bar, with the face of the square in contact with the end of the bearing. Measure the distance from the end of the piston pin boss to the upper end of the square. Move the square to the other side of the rod and repeat the measurement. See Fig. 11. If the two measurements do not compare, the rod requires straightening.

A 12 or 14-inch wrench can be used as a tool for straightening the rod, by using the wrench as shown in Fig. 12 and bending it slightly in the direction required. A final alignment check should now be made on all three operations and any necessary corrections made, until the rod checks accurately on the test bars at all three points.

Crankshafts

Crankshafts should be checked with a micrometer to determine whether or not the crank journals are out of round, and how much the main journals are worn. If the main journals are unevenly worn or slightly scored, they can be easily smoothed and polished with file and emery cloth in a lathe. New main bearings, which are nearly always undersize, will have to be installed and line-reamed to size.

Crank journals that are more than .001 inch out of round can be mounted in a lathe with an off-center set-up and reground, providing such equipment is available. However, if it is possible to secure a new crankshaft, it will probably be found cheaper to do so, because undersize crank journals will require replacing the crank rod bearings. If the crank rod bearings are to be replaced because of damage or burn out, the grinding

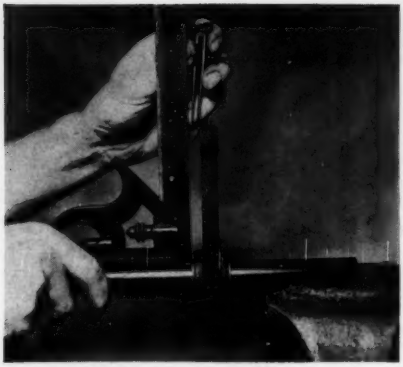


Fig. 11. Checking piston pin boss for centering with crank bearing.

Fig. 12. Using a 12-inch wrench to bend the rod so that the pin boss centers with the bearing.

of the shaft is economically possible.

The seal face at the end of the shaft should be reground if scored or if the surface is not flat. This operation is also done in a lathe, followed by lapping to secure a finely finished surface. The alternative to regrinding the surface, where the equipment is not available, is to install a replaceable shaft seal seat, which is sealed against the shaft shoulder with a neoprene gasket. These seats are available from your jobber.

Valve Plates

The valve seats of most valve plates can be renewed by lapping the seat on a lapping block with the same materials and in the same manner as seals. There are some plates, however, which have countersunk valve seats, or seats which are ground with a curvature. These are much more difficult to renew because they require specially shaped lapping tools or resurfacing in a grinding machine. Valve plates are sufficiently inexpensive that they do not warrant much labor on them, where a new one is available. Where new plates are not available, new valve inserts applicable to nearly any valve plate can be secured from your jobber and installed by any machine shop.

Reassembling

All parts should be washed in carbon tetrachloride before they are assembled, to remove any dirt, lint and oil film accumulated during the repair and test operations. Allow the parts to dry in air, and do not use any rags or other sources of lint to wipe parts during assembly.

After the shaft, connecting rods, seal, pistons, and pins have been assembled in the crankcase, and while the cylinder block is being assembled to the crankcase, care must be taken to see that the cylinder block is properly aligned before the cap screws are tightened. The cylinders must be in line with the crankshaft and centered so that the connecting rods do not bear against the faces of the piston bosses in either the forward or backward position of the crankshaft. This should be checked by seeing that the shaft has the proper end clearance and turns without binding. A certain amount of clearance in the bolt holes of the cylinder block will permit a slight adjustment in the position of the cylinder block. The renewal of the thrust ball at the end of the shaft and adjustment of the thrust washers will allow for further end clearance adjustment of the shaft. The amount of end clearance will vary widely from one compressor to another, but as a general rule, should not be less than .004 inch. Clearances over this amount will not do any harm since the important thing is that the crank bearings are centered with the cylinders.

Head Clearance

Probably the most often overlooked point in assembling the compressor, and the most important from the standpoint of efficiency, is the clearance allowed between the top of the piston and the valve plate at the end of the upward stroke.

Many compressors have received an excellent job of overhauling with perfect fits throughout and yet have failed in efficiency because no attention was paid to the head clearance. Every time a compressor is dismantled for any reason whatsoever, the head clearance should be checked.

The natural wear of the parts in a compressor continually tends toward shortening the distance between the top of the piston and the crankshaft, as illustrated in Fig. 13, thus increasing the space between the top of the piston and the valve plate. This increase in clearance is measurable in such small amounts as thousandths of an inch, but the decrease in efficiency will represent several percent of the total capacity of the compressor. Overhauling the compressor does not always restore this clearance because nearly all the wear on connecting rod bearings occurs on the top half of the bearing, and when the bearing is scraped and refitted, more metal is taken off the top half, thus increasing the head clearance. Likewise, if piston pin bushings are reamed to take oversize pins, the reamer follows the general contour of the hole and removes an equal amount from the top and bottom.

The head clearance should be between .007 and .010 inches, and is obtained through the proper thickness of gaskets used between the valve plate and cylinder block. The block and plate should be thoroughly cleaned of old gasket material, which may be clinging to them, and all burrs around the bolt holes should be removed so that the surface is smooth. Mount the valve plate on the cylinders without a gasket and with two or three cap screws loosely screwed in to keep the plate in location.

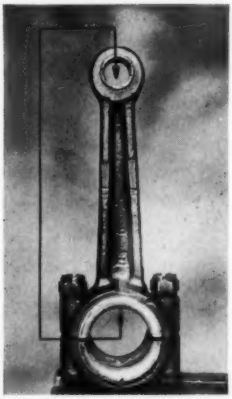


Fig. 13. Indicating the direction of wear on the piston pin hole and the crank bearing which tends to shorten the working length of the rod and increase the head clearance.

Turn the compressor by hand until one piston reaches top dead center. As the piston rises, it should raise the valve plate slightly off the cylinder block. If it does not, it will probably be necessary to install a thinner gasket between the cylinder block and crankcase.

With the piston at top dead center, hold the valve plate parallel with the cylinder block, and using feeler gauges as indicated in Fig. 14, measure the distance between the plate and the block. These measurements

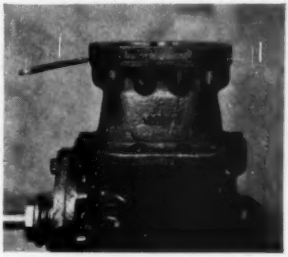


Fig. 14. Determining the thickness of the head gasket by measuring the space between the valve plate and cylinder block while the piston is in the top dead-center positon.

should be taken at several points, and with each piston in turn at the top, in an effort to strike an average clearance. When this clearance has been obtained, add to it the operating clearance desired in the head, thus obtaining the thickness of the gasket needed.

Gaskets are usually obtainable in two or three thicknesses, and as many as two may be put together to build up to a desired thickness. More than two are not recommended. Some allowance should be made for compression of the gasket when the head bolts are drawn down.

After assembly is complete, the compressor should be run under no load for a period of four hours, which constitutes the running-in period and permits any tight bearings to wear in and loosen up. This is important because a newly-overhauled compressor immediately placed in service may burn out a bearing. The oil used during the run-in period will usually become very dirty, and for this reason should be drained out. Flush the compressor with carbon tetrachloride, then dry in an oven.

During the drying process, any neoprene gaskets or washers, such as are contained in some seals, should be removed, because neoprene deteriorates at temperatures above 150° F. Reinstall the seal after drying is complete, and while the compressor is still warm. Charge in the right amount of oil and seal the compressor openings against air leakage.

(Concluded)

COMMERCIAL

INCREASE BUSINESS BY DOING A MORE EFFECTIVE JOB OF SELLING *Selling*

Photo Labs Need Refrigeration Too!

By Robert Latimer

A FIELD in which refrigeration service firms can find an excellent market for highly specialized refrigeration installation and service is represented by photographic stores, according to numerous middlewestern service organizations who have found this business highly profitable. Photographic supplies, including film, delicate chemicals and treated papers, are highly in need of good refrigeration methods—but seldom are they so protected.

Because such work is usually beyond the reach of either the air conditioning contractor or the appliance dealer handling package cooling up to five tons capacity, this branch of the business offers an ideal field for the refrigeration service firm capable of engineering specialized refrigeration for the dozen-odd uses which occur in all branches of film finishing and camera-store retailing. A good example is furnished by Union Refrigeration Service Company of Kansas City, Missouri, which recently spent two weeks in surveying these prospects, and has sold installations which ranged from cooling coils for use in developing and fixing trays to a $5000 cooling system for a warehouse, darkroom, movie developing room, and darkrooms rented to the public. The Kansas City firm, which formerly devoted all its time to large-scale refrigeration such as ice plants, ice-cream freezers and cases, and other such refrigeration, has to date sold more than $10,000 in unusual equipment and individually engineered installations for the photographic trade.

The company entered the field two years ago, after the management made a study of potential markets, and found that numerous camera stores in Kansas City were annually expecting the loss of hundreds of dollars in ruined chemicals, fogged film, and spoiled finishing because of temperatures running up to 100 degrees during the summer season. A representative of the company visited twenty-six stores; found that each felt the need of cooling for chemicals and darkroom liquids badly, but had never been able to successfully apply any cooling with the exception of ice cubes packed around trays, etc. Principal difficulties involved were precipitation of fluoride chemicals under extreme humidity and heat, "fogging" of supersensitive film in developing processes (which means loss of customers as well as the profit on the finishing) and deterioration of film

and supplies while merely stored in extreme heat.

"This seemed like an excellent market to us," it was explained. "Simply because every dealer proved interested, and a few had actually taken a few steps to prevent such losses with rudimentary refrigeration methods. One dealer had bought a one-ton package air conditioner for his darkroom, thus being fairly successful in cutting down finishing damage, but his stock was not protected. We found another who had taken the coils from an ordinary refrigerator, placed them in his porcelain developing trays, and achieved a certain degree of cold, although the hypo was usually too cold at one time, too warm at another. In all instances, however, the dealer asked us to make some suggestions to overcome the heat problem."

Since that time, the Union concern regularly circularizes all photographic dealers in the two Kansas City areas (including Kansas City, Kansas) with an offer of a check of the store's possibilities to prevent heat loss, quoting examples of other dealerships, and pointing out to camera-store owners that often savings in these "profit leaks" will frequently pay refrigeration costs in their own right. A direct mail piece of this type is sent in late May, repeated in June, again in July, and finally in August. Letters are all typed, signed by the president of the firm, and personal to the extreme. Response is always good, and every inquiry quickly followed up.

Servicemen Trained as Estimators

Union's servicemen are all trained estimators, and can quickly see the possibilities in every contact. For example, one large dealership in Kansas City maintains five darkrooms in its rear building, complete with supplies, which amateur photography fans may use for 45 cents an hour, to do developing and finishing of their own. This profitable rental business had fallen off to nothing during the summer. In addition, the store had a 30x16 foot storeroom, a commercial finishing room in the basement, and a film vault near the front. For this problem, the company installed forced-air cooling in the basement and the rental darkrooms, gun coolers in the film vault to keep the temperature around 50 degrees, and a similar installation in the storeroom. Copper tubing was run from the refrigerant main to the darkroom coolers, wrapped around the fixed developing trays, and insulated—this providing a proper 56 degree temperature for finishing chemicals. This simply-planned installation saved the dealer $800 the first year, will probably double that amount in 1942.

In another case, where a dealer did no finishing, but sold film and supplies, the Union company chose a small room, formerly used for rubbish storage, to make a refrigerated film vault. Walls were lined with two inches of cork, over which aluminum foil was placed. Shelving was placed in the center of the room, high enough off the floor to allow for air circulation, and flat coils placed on the ceiling. Weatherstripping the door, and connecting a small ice-cream box compressor now gives this dealer ample storage room at 60 degrees the year around for $3500 in film supplies —none of which runs a risk of deterioration as was formerly the rule.

Almost all such installations have been made with miscellaneous parts in stock at Union, and have enabled the company to utilize a great number of old compressors, tubing, connections etc., profitably and with a guarantee. Since no two are alike, the management quotes no definite price for any job until after a thorough survey has been made, then extends liberal terms which any camera dealer can understand and appreciate. As a result, Union Refrigeration Service Company is getting profitable sales at low cost, using up otherwise worthless parts and supplies, and making itself hundreds of new friends each year.

One of the Larger Dark Room Installations Made by Carrier Corp.

Blemishes in newspicture negatives due to variations in developing solution temperatures have been practically eliminated in the modern photo laboratories of Philadelphia's "Evening Bulletin," since air conditioning was installed, according to Edward T. Murphy, vice president in

charge of marketing, Carrier Corporation, Syracuse, N. Y.

"In addition, elapsed time from exposed negative to final print has been cut down to seven and a half minutes with the help of air conditioning and other modern devices."

The problem of double-quick photographic processing is an acute one in these days of fast picture work and high speed news publishing, Mr. Murphy declared. The "Bulletin" was one of the first to recognize the important part air conditioning might play in speeding up this work.

Rapid developing, fixing and washing of prints has been achieved in the completely air conditioned "dark room" through the introduction of up-to-date methods. Even hot air and fumes generated by carbon arcs used in the printing room are removed through forced ventilation.

Films are dried in a centrifugal dryer. Electrically heated ovens are used to dry prints not marked "rush."

"Some years ago, the Bulletin decided to completely reorganize and rebuild their photo laboratory, in line with a complete modernization program for the entire building," Mr. Murphy said. "Cleanliness, speed and comfort have been achieved in the newspaper's 'dark room', as a result."

Repair agreements spread shop's work year around

Selling Maintenance Contracts Demands Careful Initial Survey

By B. K. Anderson

This shop has built up its winter business with maintenance agreements — mainly with apartments and businesses—and keeps same crew busy the year around.

THE SERVICE engineer has three important selling aims, according to Ted Weeks, owner and manager, Ted Weeks Refrigeration Service Company, Kansas City, Mo. Those aims are: the sale of satisfactory service; the sale of refrigeration equipment; and the sale of repair agreements or maintenance contracts.

In each of these fields, Mr. Weeks believes, an entirely separate sales program is necessary. In selling service the name of the company and its reputation for satisfactory service must ever be kept to the fore. In selling refrigeration equipment an aggressive follow-through effort is needed. But, in selling maintenance contracts the customer should be engineered into buying the service.

"And the one most opportune time for the customer to buy, rather than being sold, this service contract is right after a major repair job has been completed on the prospect's refrigeration system," Mr. Weeks explains.

His reasons for this are exact: Selling is easier because the customer has just experienced a failure in his unit, has been presented with the bill and realizes that more expensive repairs may be needed later.

The service firm is in a better position to offer the contract because it has had an opportunity to closely study the unit it will service under the agreement; and because the needed repairs have just been completed and would be under a limited warranty by the company anyway.

From a sales standpoint the customer and the firm are already in contact on the subject, which always is a very strong advantage in any sale. The service man, doing the work on the job, makes the suggestion to the customer more as a tip

on how to keep refrigeration costs at their lowest. From then on it's up to the customer, there is never any follow-up because the entire repair agreement is always treated as a special accommodation-service.

"And, actually," Mr. Weeks says, "we don't want too many of our apartment and business customers on this service basis. First because we have not found it as profitable as per-call work. Second, because after we have had a customer on this basis for a few years most of the kinks in their refrigeration units have been ironed out and they go back on a per-call basis, and third, we believe in balance in both service and merchandising and do not want to develop one branch ahead of the others.

"Actually these maintenance contracts in the refrigeration service field amount to the same thing as preventive medicine in the medical profession. Records prove that they save the customer up to 50 per cent in refrigeration cost by giving the unit longer life, by preventing break-downs, and cutting service and repair costs.

"For example, if we find that the bearings are down and fix them then it costs about six or eight dollars. If this isn't done then the cost after the break-down is about $23.00. The chances are that only a maintenance contract would catch this condition in advance."

Agreement Used

The repair agreement used by Weeks Refrigeration Service is that supplied to its dealers by Frigidaire. Actually the contract is just a signed order which states that the firm will make all repairs and replace all parts in the customer's refrigeration system for the period of one year for a sum agreed upon and paid by the customer in advance.

If, in that time, another service company is called in, the firm is not responsible for any of the units thus repaired or the cost of this work. (In these cases, however, where through accident another service firm is called, Weeks will foot the bill provided it is legitimate.)

"We're still service engineers," Mr. Weeks explains, "our first duty is to keep the customer satisfied, regardless of the terms of our contract.

"We get around to all our contract customers at least once every 60 to 90 days. Janitors are instructed on 30-day oiling and our service men also do this when they call."

Weeks keeps a record of every contract unit and when there is a breakdown they replace the motor or coil or whatever unit may be broken down and bring the piece into the shop for overhaul. This saves the customer greatly in time and convenience and cuts repair costs for the company. It also allows them to make repairs when service calls are slack.

Average Cost

Most of the firm's contracts run from a minimum of $17.50 to a top around $40.00. In a few cases the customer is allowed to pay this in two semi-annual installments but more often the entire annual sum is paid in advance.

This figure is arrived at on a basis of the size of the compressor or the number of kitchens (whichever carries the larger fee), and the general condition and use of the units. The service company is not responsible for misuse, neglect, acts of God (such as fires, storms, explosions, etc.) or adjustments made by other than company service men.

In Mr. Weeks' opinion, "The first inspection of the unit spells success or failure for the contract. Too much attention cannot be given to what the service man is insuring for the next year. The first year of the contract is always the least profitable and the third year the most profitable.

"A large service firm employing 10 or more men can make a good profit if 5 per cent or more of its volume is on a contract basis. However, the insurance angle is so strong that it is an actual gamble for the firm to have more than 20 per cent of its business in this category."

Weeks carry about 80 accounts in this bracket regularly. They employ 14 service men the year around and have had as high as 2408 service calls in one month of which less than 5 per cent were on a

(Continued on page 46)

MR. S
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Your Government Has Provided You with a Handy Tool . . . PRIORITIES to Enable You to Carry On . . .

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The Question Box

Readers are invited to send their problems pertaining to the servicing of household refrigerators and small commercial refrigerating equipment to "The Question Box."

BRASS IN AMMONIA SYSTEM

QUESTION 446: Lately, I had to replace the main bearings on a Model 210 Lipman Ammonia Machine, which had Babbitt bearings. The machinist who made the bearings for me said that he wanted to make them out of brass, which he did. Since then I have read in two service manuals that brass should not be used with ammonia. Do you think they will hold up or not? Will they have any other effects on the system?

This machine also has an Alco automatic expansion valve, and the needle and seat won't last over six months. Do you know any reason for this?

Recently I went out to a small town, and not knowing the make of the household box I was to service, I did not carry any Freon with me. The box was a Wizard make, and when I told the lady I did not have any Freon with me, she insisted that I put methyl chloride in it. I told her that I could not guarantee the machine to work with methyl, but it seemed to perform all right, except that it frosts the outside of the box. Do you think it will work all right? And do you know who makes the Wizard box?

ANSWER: Of course, your service manuals are correct and brass or copper should not be used on ammonia machines. However, I don't think that anything will happen to the brass bearings that you have used in the Lipman compressor. The oil in the compressor will protect these bearings from any ill effects of the ammonia; providing there is always sufficient oil in the compressor and that too much moisture is not present, the bearings will hold up satisfactorily.

The fact that the needle and seat of the Alco expansion valve does not hold up more than six months is probably due to an undercharge of refrigerant. It's possible that you have air in the system, which gives you an indication of sufficient refrigerant in the system, or it may be that the system has a small condenser and liquid line, which causes a comparatively high head pressure for the amount of gas it contains. I believe I would try adding more ammonia to the system and purging off air. An indication of these troubles would be that the liquid line should be warm or hot. The usual effect of a low refrigerant charge is that vapor refrigerant is passing through the expansion valve a good part of the time at a rather high velocity, which causes the seat to cut out.

Another possibility, too, is that a certain amount of fine silt or sandy substance is in the system, which is carried through the expansion valve at a high velocity, and this will add to the cutting action considerably.

Putting methyl chloride in a Freon system, or in other words, mixing Freon and methyl chloride in the same system will do no other harm, and will probably not be noticed except for a slight variation in temperatures in the evaporator. Methyl chloride and Freon will have a tendency to separate in the evaporator under various temperatures and pressures, and the usual effect is that there will be a varying suction pressure and temperature in the evaporator.

It is quite probable that your customer will not notice any difference and the machine will operate satisfactorily.

I have never heard of the Wizard refrigerator, and I take it for granted that this is an assembled job, put out under the private name of some smaller company in the state in which you live.

VALVE DOUBTFUL

QUESTION 447: I am having trouble with a Hussman reach-in box which has a Detroit expansion valve. It has a row of coils at the top, center and bottom. The top row will frost about halfway of the box and the rest of the coils will get just a little cool. The expansion valve is covered with frost about four inches thick. This is hooked up with a Lipman compressor charged with four pounds of methyl chloride and pulled with a ⅓-h.p. Wagner motor. It doesn't have a full charge, and will this undercharge cause this trouble? It has to run practically all the time to keep the box near the right temperature.

ANSWER: I believe that your trouble is due to a low charge of refrigerant. However, there is the possibility that it is partly due to the expansion valve's being out of adjustment, or even defective.

You have not told me whether this expansion valve is of the automatic type or the thermostatic type. However, I don't be-

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Same as above with safety cut-out feature.

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SE-4099	+20° to +70°	

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For all refrigeration temperature control applications up to ½ H.P. Adjusting nut on outside of case. Differential 5° to 25°.

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SE-4094	−15° to +35°	$4.85
SE-4095	− 5° to +45°	

★**CLOSE OUT OF SWEAT & FLARE MANIFOLDS**
2-3-4 valve 46c up.

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For Methyl, Freon, or Sulphur (specify choice when ordering). Differential 4½ to 25 lbs. Range 20" to 50 lbs.
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HI-PRESSURE CUT-OUT AND TEMPERATURE CONTROLS
For Methyl, Freon, or Sulphur. (Specify choice when ordering). High pressure cut-out settings: SO₂ 131 lbs., Methyl 157 lbs., Freon 200 lbs..

No.	Range	Net Each
SE-3813	−20° to +40°	$6.95
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Here is an authoritative guide for every owner and operator of a refrigerated locker storage plant

REFRIGERATED LOCKER PLANT MANUAL

BY WARD E. GUEST

Based on actual experience—not theory

THIS new book is specifically designed to furnish practical answers to problems that arise in locker plant operation every day.

It brings home to the locker plant manager and operator sufficient facts to cause him to realize the scope of knowledge he must possess in order to fully and profitably serve his plant and community.

The author has drawn not only upon a wide experience as a pioneer in the construction and operation of locker plants, but also the knowledge of leading authorities and other successful plant operators.

The book is factual—it is comprehensive in its description of the various steps in a successful locker plant operation. This is a book every plant manager and operator will find most helpful. It is an operator's book in every sense of the word. A valuable guide to check your individual operation—and most important, based on accepted practice and experience. Many plants will want more than one book.

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Quick Freezing and Storing Meat
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lieve that that makes a great deal of difference.

The best procedure is to charge the system with the proper amount of gas to begin with, then try to obtain the proper adjustment on the expansion valve; or, in other words, adjust the valve until the coil is completely refrigerated.

If this does not overcome your trouble satisfactorily, then I would suggest that you remove the valve and test it for leaks and for proper operation.

REFRIGERATING A DEVELOPING TANK

QUESTION 448: In reading through THE REFRIGERATION SERVICE ENGINEER, I find that you have answered quite a number of questions that were puzzling to servicemen, and I am sure you could give me some help on my particular problem.

We are trying to wind coil (copper) on the outside of a tank filled with developing solution for developing pictures. We would like to know how to refrigerate these tanks (stainless steel) so as not to be bothered with electrolysis.

ANSWER: I don't believe that I would attempt to wind a copper coil around the stainless steel tank used in photography work. The difficulties encountered here would probably make this impractical.

One of the difficulties would be in maintaining the rather close limits of temperature required in photography, and another would be in getting a satisfactory bond between the stainless steel and copper. Solder does not take very well to stainless steel and it is quite probable you would have difficulty in completing the job.

Use a Water Bath Around Tanks

A much more satisfactory method, I believe, is described in the November, 1940, issue of THE REFRIGERATION SERVICE ENGINEER on page 22. The method illustrated there, of course, shows the use of developing trays instead of tanks; however, the same principle would apply. In your case I believe it would be better to construct another tank of galvanized iron, which would be large enough to allow approximately an inch and a half space all around the one or more developing tanks which are to be cooled.

Your coil could be wound in such a manner as to be spaced approximately in the center, between the developing tank and the outer tank which you will build. This space, then, could be filled with water, since the temperature of the developing solution is usually held around 65 degrees.

This water would act as a holdover solution, and the natural circulation of the water would tend to equalize the temperature around all parts of the developing tank. It would also be much easier to control the temperature of the developing solutions within the desired limitations.

The tank should be covered so that when removing films, little or no developing solution will be slopped over into the water surrounding the tank. It is this solution which will cause electrolysis or acid action on the copper tubing and tank after a period of time.

To safeguard further against this action, the customer should be instructed to change the water in the outer tank at least once a week, or where the tanks get a large amount of service, it may even be desirable to change the water twice a week.

CHANGING FROM AMMONIA TO LOW PRESSURE GAS

QUESTION 449: I would like to change over several ammonia plants with aluminum fin coils to low pressure gas, using either Sulphur or Freon. How do these gases react on aluminum? Please give me the best method of cleaning out coils in which ammonia was used.

ANSWER: In order that you won't reduce the capacity of the machine more than is necessary, Freon should be used. In this present shortage of Freon, however, you may have to use methyl or SO_2. Aluminum coils cannot be used with methyl. Cleaning the ammonia system can be done by circulating water through the system to remove all traces of ammonia.

Following that, alcohol should be circulated to remove the water, and then, of course, the system must be dried.

For further ideas on the change refer to the article on Freon Shortages in this issue.

B.T.U. CONTENT OF CREAM

QUESTION 450: Assuming that the amount of heat required to raise one pound of water one degree Fahrenheit is one B.t.u., how would the B.t.u. content of 30 per cent to 40 per cent cream be estimated?

ANSWER: The B.t.u. content of any liquid may be determined from the specific heat of

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- Sludges

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that liquid. The specific heat, for instance, of water is one, or expressed in another way, it requires one B.t.u. to raise one pound of water one degree Fahrenheit in temperature. The specific heat of milk is .93, and because the weight of one gallon of milk equals 8.61 pounds, the formula, "Gallons times weight per gallon times temperature difference times specific heat," will show us that one gallon of milk requires 8.01 B.t.u. to raise the temperature one degree.

The specific heat of cream depends a great deal on the butter fat content of the cream, and therefore, various references may differ in the specific heat shown. However, a fair average figure might be considered as .84. While I have no reference which would indicate the specific heat of 40% cream, I would judge from the two other figures I have given you that a 40% cream would have a specific heat of .89.

EVAPORATOR TOO SMALL

Question 451: I would appreciate receiving information on the following problem: This is a 1½-h.p. ammonia Lipman machine. On this is an 8 x 8 x 10 feet high walk-in cooler with a Peerless unit cooler, No. 93A, with a 5,175 B.t.u. rating at 15 degrees F. temperature difference. A twelve-foot single-duty display case is also on the condensing unit.

The trouble is that the case gets too cold, and the walk-in box gets too warm; also the coils on the unit cooler frost up. There is also quite a bit of meat drying. I have to let the fan run continuously to give the unit a better chance to defrost.

Would it do any good to put a solenoid valve in the liquid line of the display case, which would be connected to the thermostat in the case to close the liquid line when the case became cold enough? Would it do any good to cut the fan off on an off-cycle?

Answer: You have not told me anything of the construction of this cooler or anything that may give me a definite means of figuring the heat load. I would judge, however, that an 8 x 8 x 10 cooler would impose a load of about 6,300 B.t.u. per hour on the condensing unit, figuring on the basis of sixteen hours' operation.

You state that the Peerless unit cooler installed in the cabinet has a rating of 5,175 B.t.u. This would indicate then that the Peerless unit is much too small for the walk-in cooler. This, in addition, is indicated by the fact that the cooler is frosting and you are still unable to obtain a cold enough temperature.

It is possible that the installation of a solenoid valve in the liquid line of the display case would help the situation. However, I don't believe that anything can overcome the fact that the unit cooler is too small, and before spending any money on new equipment for it, I would think that the entire job should be re-engineered, and if it is found definitely that the cooler is too small, this condition should be corrected first.

TOO MUCH PRESSURE DROP

Question 452: I have a ⅓-h.p. Frigidaire condensing unit, K Model, used for ice cream cabinets, using SO_2 gas, and connected to a sweet water bath to cool milk. The size of the tank is 6 feet long, 1½ feet wide, and 2 feet deep. I have made up a ⅜-inch tubing coil 80 feet long, using a Detroit automatic expansion valve. The condensing unit is three feet from the tank, uses a ¼-inch liquid line and a ⅜-inch suction line.

My problem is this: Only 30 feet of the coil will form ice. I have tried a thermostatic expansion valve without any better results; I have increased the speed of the unit; I have added gas, but still it will not freeze any further. This all takes place when the water temperature is down to 38 degrees and there is no load on the tank. Would I get better results if I split my coil and connected the expansion in the center?

Answer: I believe the best solution for your problem is to remove the coil made of ⅜-inch tubing and replace it with a coil of half-inch tubing. The pressure drop through eighty feet of ⅜-inch tubing will amount to as much as six pounds, and this, of course, would account for the fact that only part of the coil will collect ice.

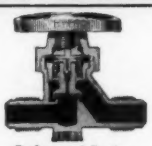
For your information, coils used in sweet water baths, where they may be operated under a partially-flooded condition, should not exceed seventy-five feet of half-inch tubing, one hundred feet of ⅝-inch tubing, or one hundred fifty feet of ¾-inch tubing. This, of course, is for coils operating on one expansion valve.

I don't know what the load on the milk cooler you describe is, but if eighty feet of ⅜-inch tubing will take care of this load satisfactorily, then undoubtedly, seventy-five feet of half-inch tubing will be more than enough.

Splitting the present coil and connecting the expansion valve in the center may possibly overcome your trouble; however, I think you would then be confronted with the problem of proper distribution to each

(Continued on page 42)

HOW MUCH IS GOOD WILL WORTH?



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Although our plant is producing as much "Freon-12" as ever, defense needs are taking a large portion of the production. But —careful estimates indicate that if waste and losses are eliminated, the saving will compensate for existing shortages. That's why you should offer a regular check-up service to conserve "Freon-12" *now*—to prevent losses before they occur. It's your opportunity to increase your business and at the same time perform an invaluable service for your customers.

Study the check list below to make sure you utilize every possible means of combatting these four major causes of waste and losses:

(1) *Leaks* **(2)** *Overcharging systems*
(3) *Incomplete removal of "Freon-12" from cylinders*
(4) *Purging "Freon-12" into the air*

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CHECK LIST
FOR CONSERVATION OF "FREON"
Do not overcharge system.
Weigh a sufficient amount of "Freon" for efficient operation.
Test system for tightness.
Use dry CO_2 or nitrogen rather than "Freon."
Evacuate shipping cylinders completely.
Condense the vapor and salvage the refrigerant.
Do not purge "Freon" into the air.
Pump the "Freon" into the receiver or into a clean, dry cylinder for reuse.
Look for accumulations of oil which have leaked from the systems. They may indicate the presence of a leak.
Use a Halide lamp or torch to locate leaks.
It gives instantaneous reaction to even minute leaks.
Check systems at these points:
Gaskets on the crankcase cylinder
Crankshaft bearing housing
Cylinder head
Stuffing box or shaft seal
Valve stems and pads
All connections (threaded, flared, welded, brazed or soldered)
Control Devices
Oil Separators
Compressor
Condenser
Evaporator
Auxiliary control apparatus
All castings and tubings
KINETIC
FREON
REG. U. S. PAT. OFF.
safe refrigerants
*"Freon" is Kinetic's registered trademark for its fluorine refrigerants.

QUESTION BOX

(Continued from page 38)

coil. If a split were being made in the present coil, it would likely become necessary to install two expansion valves instead of one.

KELVINATOR ICE CREAM CABINET

QUESTION 453: I am having trouble with a four-hole ice cream cabinet with a storage bin at the end. It is full of brine and has two pipes running over to a plate, one on the top and one on the bottom. It is a model 5577 Kelvinator unit.

I would like to know how to calibrate the float, and also the reason why it should freeze the pop and milk when it is at the right temperature for ice cream.

This is cabinet model 3669, serial 75233, Class C System Kelvinator using SO_2, and it has a ⅓-h.p. motor. The unit is marked 6#SO_2 and the cabinet 11#SO_2. The unit has an hourly capacity of 15 pounds.

The motor has been changed, and I now have a ⅓-h.p., 1760 r.p.m. Delco motor on the unit, and it seems to handle the unit easily. The motor on it, when I started, was a G-E ⅓-h.p., 1725 r.p.m., and it had trouble handling the unit.

How much gas should this unit have, and what is the best way of checking this gas charge?

ANSWER: On Model 3669 Kelvinator combination ice cream cabinet, the bottle compartment is refrigerated by the same brine solution as is used to cool the ice cream compartment. The only method of changing the bottle compartment temperature is by means of the stopcock in the line between the two compartments. Opening this stopcock allows more rapid circulation of the brine, giving a lower temperature. Closing the stopcock retards the circulation and raises the temperature.

Exchange Float

The calibration of the float requires special equipment, and unless a large number of floats are to be calibrated, the most satisfactory servicing arrangement is to exchange the entire float assembly for one that has been re-operated at the factory. This exchange can be handled by any Kelvinator factory branch at a very nominal cost.

The 3669 cabinet used two types of float: Model A-2, part number 577, and Model B-1, part number 6118.

The gas charge of this evaporator is eleven pounds, and the oil charge is one pound, eight ounces. Improper charge of gas may be indicated by any of the following conditions:

(1) Normal or excessive refrigeration with excessive running time.
(2) Poor refrigeration with normal or continuous running.
(3) Suction line frosted.

The above-named complaints may also be caused by a leaky float, inefficient compressor, defective temperature control, excessive service load in the bottle compartment, plugged strainer, float's being stuck shut.

TRUPAR UNIT

QUESTION 454: I have a Trupar refrigerator which keeps on running two out of every five minutes, even after reaching a temperature of 34 degrees F. in the cooling chamber. The cooling unit coils and float are replaced with a Frigidaire cooling unit using SO_2. My problem is whether the cooling unit or the motor control is at fault for the box's running so frequently. Where could I get the data on this refrigerator?

ANSWER: You have not indicated what type of motor control is used on this Trupar refrigerator, and it is, therefore, difficult for me to state definitely what the trouble may be. There are several possibilities, however, depending upon the type of control. If the control is a pressure switch, I would be inclined to believe your trouble was due to:

1—A leaking discharge valve in the compressor, which permits high pressure vapor to leak back into the lowside.
2—A leaky float, which will permit high pressure vapor to leak into the lowside.
3—Insufficient refrigerant in the system, which again would permit high pressure vapor to pass into the lowside.

If the motor control is a thermostat, it is quite possible that you will find this thermostat is not breaking the contact with as wide a gap as is normally intended, and with a slight change in temperature, the contacts again close.

I am sorry that there is no source through which you may obtain information on this unit, inasmuch as the lowside has been changed to a Frigidaire, and you, therefore, have a composite system.

Glenn F. Hipskind,
Washington.

Just a word about THE REFRIGERATION SERVICE ENGINEER—I find it a grand book, would not be without it now.

. . . in TECUMSEH'S

Air Filtered ROOMS

HAY FEVER victims would certainly find relief if they could work in Tecumseh's air filtered assembly rooms. The most improved system of air conditioning has been installed to make these rooms dust proof so that each Chieftain unit is assembled under the most ideal conditions. This is just one of the many reasons for Chieftain's rapid growth in the refrigeration industry.

TECUMSEH PRODUCTS CO. TECUMSEH MICHIGAN

Chieftain

Alter's "Man Bites Dog" Party

THE unusual happenings of these unusual times are sufficiently frequent that many of us are now beyond even raising an eyebrow, but when the age-old custom of the salesman entertaining his customer is reversed so that the salesman is the one being entertained, we are inclined to throw up our hands in despair at this cockeyed world.

Nevertheless, this is exactly what happened on August 26 when the Harry Alter Co. entertained the manufacturers and salesmen of the products they buy. There were about 75 of them in all, and a very enjoyable party it was. Held in the Palmer House, Chicago, and starting at 7:00 p.m., the first part of the evening was spent in a cocktail lounge, where all the drinks and smokes were provided by Harry Alter. Roving musicians provided entertainment, and in place of the usual industry gossip, the main topic of conversation was priorities and the difficulties they are creating.

A very fine dinner was served in an adjoining dining room, and several acts of excellent entertainment followed the dinner. There were no speeches other than a one-minute welcome from Harry Alter, President of the firm. The entire evening was devoted to the enjoyment and entertainment of the salesman, and during the evening he was provided with the following notice:

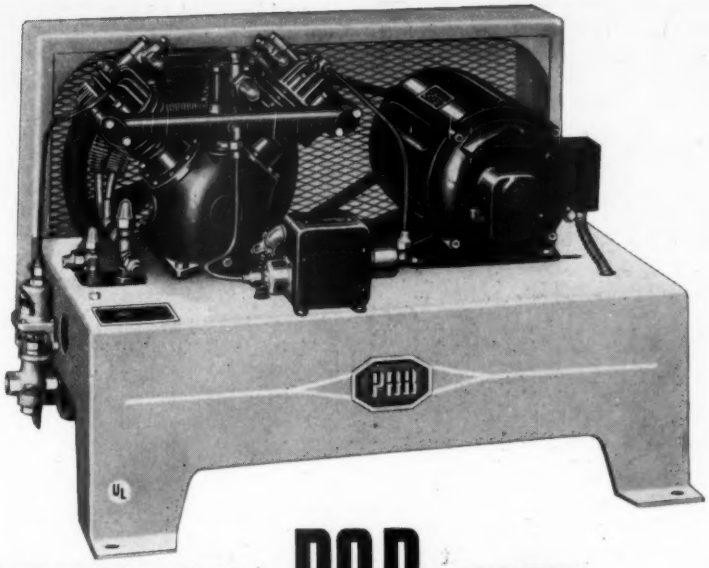
SALESMEN! You Will Be Welcome at Harry Alter's

Our buyers have just completed the Dale Carnegie Course and now observe the following rules of the company in their dealings with salesmen.

1. The buyer should remain standing until the salesman is comfortably seated.
2. Never offer to shake hands unless the salesman appears willing to do so.
3. If the salesman is from out-of-town and is lonesome, let your wife or sweetheart entertain him.
4. When entertaining visiting salesman be sure your order will be accepted by him before paying check.
5. Remember—"The Salesman Is Always Right."

PERSONALITIES AT THE PARTY

In the upper left hand corner are shown the hosts of the party, left to right, Irving, Harry and Arthur Alter. Other pictures show groups attending the party as they were caught eating, drinking, or being entertained.



RECOMMEND PAR WITH *Confidence*

Protect your own reputation and insure your customers' complete satisfaction by installing PAR refrigeration units. You can recommend PARs with full confidence . . . because they are designed, engineered, and precision-built as complete units (not just a collection of sub-assemblies hung together) to render peak performance, maximum economy, and extra years of trouble-free service!

Par Condensing units are made in both air cooled and water cooled models 2 or 4 cylinder, 30 sizes to fit the needs of any application from 1/5 to 20 H. P.

Send for FREE CATALOG

or see PAR units on display at your jobbers.

MODERN EQUIPMENT CORPORATION • DEFIANCE, OHIO

NOW!

more than ever

VISOLEAK

should be used in every system

The shortage of refrigerant is acute and no relief in sight. You can cut the loss and waste of refrigerant — and money — to a minimum by treating *your jobs* with VISOLEAK. It costs so little and saves so much.

Visoleak Shows You Those "Hard-To-Find" Leaks In Freon Systems

● Visoleak has proven extremely useful in Freon systems due to the difficulty of leak detection by ordinary methods.

HOW TO USE VISOLEAK

Use 4 fluid ounces, plus 1 ounce for each 10 pounds of refrigerant. At the low prices listed below you can't afford to be without Visoleak, it saves you money in time, effort and refrigerant loss. Your jobber carries it, or write us direct.

PRICES

4 Ounce Can	$ 1.00
8 Ounce Can	1.75
1 Pint Can	3.00
1 Quart Can	5.00
1 Gallon Can	16.00

NOTE: *change of address*

WESTERN THERMAL EQUIPMENT COMPANY
5141 Angeles Vista Blvd.
LOS ANGELES, CALIF.

SELLING MAINTENANCE CONTRACTS DEMANDS CAREFUL INITIAL SURVEY

(Continued from page 31)

contract basis. Their minimum call fee is $2.00, and during the warm months they will average 1,750 calls per month.

It is Mr. Weeks' contention that the best way to assure satisfactory work is to keep the service men satisfied with their jobs by paying them better than the average in their field and area.

"Actually the best feature of the repair agreements is that they keep your service men busy the year around. You don't have any off-season layoff," he says. "Last winter was the best cold-season in our history. The contracts can be directly credited with a large portion of this because they kept our service merchandising alive all winter. People saw our trucks and called us. Others were recommended to us by contract customers. We had no waste time to worry about.

"We expect the contracts to cost the customers more next year, as we have had to raise them before. This is done on a direct basis with advance in cost of labor and parts, which we explain to the customer. Our contract customers are made up 50 per cent apartments and hotels and 50 per cent other businesses.

Domestic Work Not Included

"We do not do any contract work on residential refrigerators because the fee we would have to charge would not appeal to this group nor be to their advantage.

"About the best you can say for repair contracts are that you do not make as much profit out of them but you do get work that you would otherwise miss and it will keep your shop busy in the winter. It also is your best source of new business in that apartment managers shift about and send you a great deal of recommended business."

Mr. Weeks was, for ten years, service manager in a large Missouri Valley area for Frigidaire. He has headed his own firm for the past three years.

WHAT WILL YOU DO WHEN THE FREON SHORTAGE STRIKES YOU?

(Continued from page 19)

ditioning compressors. The reason for this is that some of the internal parts, gaskets and the motor rotor are made of aluminum, and methyl chloride systems develop acidity which causes serious corrosion of this aluminum. In one laboratory test it was found that a Freon system converted to methyl chloride caused failure of the machine by eating out the head valves within two weeks' time.

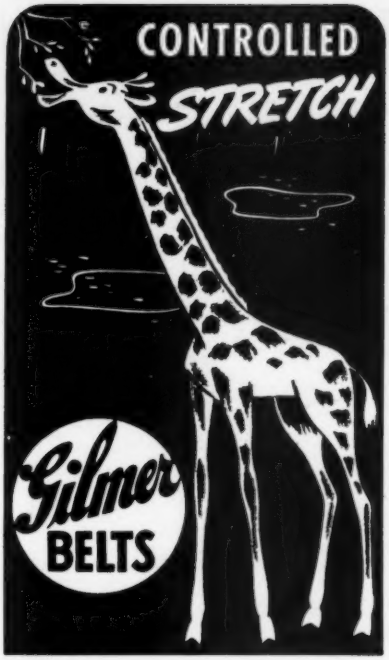
It is entirely probable that at least some of their commercial refrigeration equipment may be suitable for use with methyl chloride. Engineers, at the present time, are investigating this problem, but so far do not have a complete answer. In the meantime, however, methyl chloride is *not* to be used in type CLS or type CLD compressors. This also applies to the older type RW and type RA machines built in 1933, 1934, and 1935.

Tecumseh Products Company. It has been their policy in cases where units were originally charged with Freon-12 to advise customers to change over to methyl chloride. The displacements and speeds of the units charged with the two refrigerants are near enough identical that the conversion can be made very easily. All that is necessary is that the old Freon charge be removed and the charge of methyl be put into the system. This refers to the condensing unit only, and not to the expansion valves or other parts of the system which might have to be changed.

Some companies are advising that methyl be added to Freon units to make up the deficiency. While there would be no chemical reaction involved between the two gases, it would undoubtedly cause a change in operating pressures, and probably would cause difficulty in flooded systems due to partial separation of the two refrigerants in the evaporator and the receiver.

The most serious problem in this connection has to do with the hermetic units. In all Tecumseh hermetics we use an aluminum-cast rotor, and in this case methyl, instead of Freon, must *not* be used. Methyl attacks aluminum and results in ruining the motor, and possibly the entire system.

Williams Oil-O-Matic Heating Corporation. In the earlier years of manufacture of Williams Ice-O-Matic units, they were all furnished for methyl chloride. Several years ago, however, Freon became standard, al-



THIS is just one of the features that make Gilmer V-belts popular with refrigeration service men and their customers. Gilmer belts save unprofitable complaint calls, increase your reputation for doing the job right.

Are you saving time with your copy of "America's Belt Bible?" . . . Gilmer's catalog that tells just which belt to install on 7800 different models of refrigerators and other belt-driven appliances.

See your Gilmer jobber, or write us for a free copy, today.

L. H. GILMER COMPANY
TACONY, PHILADELPHIA, PA.

You can worry about getting FREON . . .

. . . but, you don't have to worry about HERVEEN for Meter-Misers.

★ At present, and as far as we can see into the future, there is an ample supply of Herveen available. This is the replacement gas which enables the service man to repair the Frigidaire Meter-Miser unit.

So . . . count on Herveen for this season at least, if your jobber doesn't handle it *(most do)* write us direct.

HERVEEN

MODERN GAS CO., Inc.

Manufacturers and Refiners

1084 Bedford Ave., Brooklyn, N. Y.

though methyl chloride was still optional and was regularly furnished to some customers who insisted on methyl chloride. At about the same time, they discontinued the domestic line, which had always been methyl chloride.

Any compressor units originally manufactured for Freon may be used with methyl chloride. So far as the machine is concerned, the setting of the high-pressure safety cut-out should be reduced from 220 pounds to 175 pounds; this can very readily be done on all 1941 models by simply changing the adjustment on the inside of the control. On the previous models where the type "L" Penn switch was used, some difficulty may be experienced in some instances in getting the setting down to 175 pounds.

On installations in Chicago, the Henry relief valve on the receiver should, of course, be changed.

No change in pulley speed is necessary, the methyl chloride units simply having slightly lesser capacity.

Copeland Refrigeration Corporation. Methyl chloride should never be used with an aluminum evaporator, or where there is any portion of aluminum castings in the refrigerating systems. This would apply to domestic refrigerators manufactured by Gale Products, Universal Cooler Corporation, Copeland, and Stewart-Warner. This would also apply to Copelametic units which make use of an aluminum rotor.

Domestic units with an automatic expansion valve usually have the expansion valve adjusted for approximately ten to twelve pounds of Freon. This adjustment, of course, would be changed to five or six pounds with methyl chloride.

Due to the fact that the majority of installations have installed a unit somewhat heavier than the load required, it is not advisable to make changes in the motor pulley; in other words, the compressor r.p.m. may remain constant and the overall capacity will not be changed more than five to ten per cent.

Baker Ice Machine Company, Inc. Due to the fact that substitution of methyl chloride for Freon in the average system involves different changes, according to the particular type of installation, no standard procedure can be established.

The Baker Ice Machine Co. invites service engineers to communicate with them with reference to such changeovers, and will furnish the necessary information.

There is a variation in displacement between Freon-12 compressors and methyl chloride compressors for comparable capacity, and in some instances, compressors may be on the border line of maximum allowable speed. In this case, it is barely possible that a larger compressor might be required, or in many cases, a change in the speed of the present compressor must be made.

Curtis Refrigerating Machine Company. Freon and methyl chloride can be mixed. The pressure temperature of the methyl will be in relation to the amount of the two different gases. Only pure methyl chloride should be used. Methyl chloride with the inhibitor can be used only when all the Freon is withdrawn.

Oil will not have to be changed, since methyl chloride and Freon are similar gases, and the same oil may be used.

The important thing, of course, is the pressure setting of the pressure switch. This setting must be lowered with methyl chloride.

When the entire charge is replaced with methyl chloride, the capacity of the condensing unit is reduced by about ten per cent. If the condensing unit requires full capacity, a larger pulley should be installed, increasing the compressor speed about ten per cent.

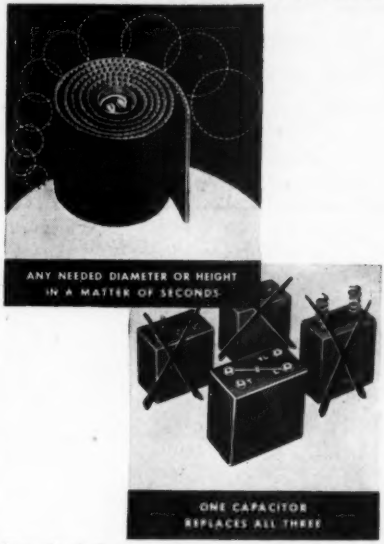
Allocation of Freon-12 During Month of September

During the month of September the greater part of the "residual supply" of "Freon-12" will be shipped to Classifications A, B, and C for the maintenance of refrigerating machinery already installed at the date of the order. This amount should slightly exceed the average monthly requirements of Classification A, B, and C customers during the twelve months ending June 30, 1941, as shown by the records of Kinetic Chemicals, Inc.

All orders which are filed with your supplier should be classified as A, B, or C, strictly in accordance with the definitions of OPACS, if the "Freon-12" is required for maintenance, and as D if it is to be used in refrigerating or air conditioning equipment that has not previously been operated. This is mandatory under OPM General Preference Order M-28, which is supplemented by OPACS Program 1335.31 to 1335.36, inclusive. You are responsible for the accuracy of the classification under the OPACS Program.

Replacement is a matter of minutes with

MALLORY Universal AC CAPACITORS



You don't have to waste time figuring out ways to make a firm fit on motor start capacitor replacements when you standardize on Mallory. Round types MSU are encased in the smallest possible metal containers and equipped with a specially developed "size adjuster" that provides any needed diameter up to 3" and any height up to 4¾". You simply trim it in the desired places.

Rectangular types MSG and MSF are packed with complete hardware for every replacement requirement.

Cut your inventory investment in half... and improve your service and profits at the same time. Standardize on Mallory.

Send for Catalog

Write today for Catalog M-801 giving complete details and replacement recommendations.

P. R. MALLORY & CO., Inc.
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Cable Address—PELMALLO

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MALLORY

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Official Announcements of the activities of the National Society and Local Chapters appear in this department as well as articles pertaining to the educational work of the Society.

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To further the education and elevation of its members in the art and science of refrigeration engineering; for the reading and discussion of appropriate papers and lectures; the preparation and distribution among the membership of useful and practical information concerning the design, construction, operation and servicing of refrigerating machinery.

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(Continued on page 51)

THAWZONE PLAYS ITS PART IN OUR NATIONAL DEFENSE!

From Maine to Hawaii, Thawzone is performing its constant function in the dehydration and neutralizing of refrigerants used in refrigeration equipment for food and beverages in army cantonments. An important job, in fact, an M. P.'s job, for . . .

Thawzone literally polices the refrigeration system, searching out water and acids wherever they may be found, chemically changing them into harmless, anhydrous compounds, which remain dissolved in the oil and refrigerant, thus avoiding the possibility of "freeze-ups," corrosion and copper-plating. Since it is a liquid, Thawzone constantly circulates throughout the entire system . . . it *goes to* water . . . an important advantage over fixed driers.

ASK YOUR JOBBER

for Thawzone in the original package, with the blue, white and black label.

HIGHSIDE CHEMICALS CO.
Newark, N. J.

THAWZONE
Full, Protected by U. S. Patents
The PIONEER FLUID DEHYDRANT

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(Continued on page 52)

FREON RATIONED!!

Methyl Chloride Shortage Likely

Every pound of refrigerant must be used to the best possible advantage in order that the supply will take care of the maximum number of customers.

Refrigerant should not be added to a system unless absolutely necessary and then just enough to insure satisfactory operation. If an accurate test is made and the minimum of refrigerant added on every service call, the number of machines which can be serviced will not be seriously curtailed.

The LIQUIGAGE will tell you **exactly** how much refrigerant is contained in the liquid receiver of the system you are servicing and **exactly** how much (in pounds) must be added to bring it to the desired level. It makes your diagnosis of trouble positive and eliminates entirely all waste of refrigerant.

Price $17.50 Net, Complete with 4 tees for 1/4" liquid lines.

ORDER FROM YOUR JOBBER
or direct from

THERMAL ENGINEERING CO.
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Toledo, Ohio

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(Continued from page 51)

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ST. LOUIS CHAPTER, ST. LOUIS, MISSOURI: Meets 2nd and 4th Thursdays. President, O. E. Petri, 3725 N. Taylor St., St. Louis, Missouri. Secretary, L. L. Vollman, 5342 Nagel Ave., St. Louis, Missouri.

SAN DIEGO CHAPTER, SAN DIEGO, CALIFORNIA: President, H. E. Friedrichs, 2716 Frankfort St., San Diego, California. Secretary, M. R. Hanks, 4072—38th St., San Diego, California.

SCRANTON CHAPTER, SCRANTON, PENNSYLVANIA: President, Karl Muller, 1514 Holly Road, Dunmore, Pennsylvania. Secretary, Chris G. Hess, 321 N. Everett Ave., Scranton, Pennsylvania.

SIOUX CITY CHAPTER, SIOUX CITY, IOWA: President, H. R. Eriksen, 1303 W. 19th St., Sioux City, Iowa. Secretary, A. L. Ricard, 2115 Nash St., Sioux City, Iowa.

SPRINGFIELD CHAPTER, SPRINGFIELD, ILLINOIS: Meets 2nd and 4th Wednesdays. President, R. M. Potter, 102 E. Cook, Springfield, Illinois. Secretary, Edw. P. Greig, 223 E. Adams Street, Springfield, Illinois.

TOLEDO CHAPTER, TOLEDO, OHIO: Meets 2nd Wednesday. President, Paul Sizer, Waterville, Ohio. Secretary, Paul F. Roop, 2529 Marlboro, Toledo, Ohio.

TRENTON CHAPTER, TRENTON, NEW JERSEY: President, George Frie, 723 Puritan Avenue, Trenton, New Jersey. Secretary, Samuel Cohen, 215 E. Front St., Trenton, New Jersey.

TRI-COUNTY CHAPTER, ELGIN, AURORA and JOLIET: Meets 1st and 3rd Fri. President, Harold Anderson, 1207 Connecticut Ave., Joliet, Illinois. Secretary, Clarence C. Stumpf, 733 Dundee Ave., Elgin, Illinois.

TRI-STATE CHAPTER, HUNTINGTON, WEST VIRGINIA: Meets 2nd and 4th Tuesdays. President, Forrest Poole, 1246 Coles Blvd., Portsmouth, Ohio. Secretary, Carl Ackley, P. O. Box 685, Portsmouth, Ohio.

TWIN CITIES CHAPTER, MINNEAPOLIS, MINNESOTA: Meets 1st and 3rd Tuesdays. President, A. M. Palen, 3225 41st Ave., So., Minneapolis, Minnesota. Secretary, J. C. Ehlers, 468 Jackson St., St. Paul, Minnesota.

VIRGINIA CHAPTER, RICHMOND, VIRGINIA: President, Ralph W. Lampie, 3719 Yawter, Richmond, Virginia. Secretary, B. A. Hauck, 4A-South Auburn Ave., Richmond, Virginia.

WESTERN MASSACHUSETTS CHAPTER, SPRINGFIELD, MASSACHUSETTS: Meets 2nd and 4th Wednesdays. President, Arthur D. Hebert, 17 Ferry St., Willimansett, Massachusetts. Secretary, Earle W. Fassell, 53 Queen Ave., W. Springfield, Massachusetts.

WICHITA CHAPTER, WICHITA, KANSAS: Meets 1st and 3rd Fridays. President, Frank H. Richards, 645 N. Lorraine Ave., Wichita, Kansas. Secretary, Howard N. Haselwood, 737 N. Main St., Wichita, Kansas.

WINNIPEG CHAPTER, WINNIPEG, MANITOBA, CANADA: President, J. B. Shepherd, 494 Clifton Street, Winnipeg, Manitoba, Canada. Secretary, R. F. Castling, 181 Burrin Ave., W. Kildonan, Winnipeg, Manitoba, Canada.

WOLVERINE CHAPTER, LANSING, MICHIGAN: Meets 2nd and 4th Tuesdays. President, O. S. McGuffy, 1812 N. Genessee Drive, Lansing, Michigan. Secretary, Vernon K. Jones, 1310 E. Mt. Hope Ave., Lansing, Michigan.

WORCESTER CHAPTER, WORCESTER, MASSACHUSETTS: Meets 1st and 3rd Tuesdays. President, T. H. Cronk, 15 Perkins St., Worcester, Massachusetts. Secretary, Stuart Garland, 32 Neptune Road, Worcester, Massachusetts.

WYOMING VALLEY CHAPTER, WILKES-BARRE, PENNSYLVANIA: President, F. M. Schultz, 161 Sambourne St., Wilkes-Barre, Pennsylvania. Secretary, E. E. Swank, 226 Lee Park Ave., Lee Park, Wilkes-Barre, Pennsylvania.

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Plan Now to Be in Chicago
R.S.E.S. Convention

8th ANNUAL MEETING—JANUARY 12-15

IF there ever was a time when your business required your attendance at the Refrigeration Service Engineers Society Convention and All-Industry Refrigeration and Air Conditioning Exhibition, the present situation provides that opportunity. It is needless to repeat how rapidly conditions have changed during the past few months, and we recognize that still further changes are inevitable. Business today requires a new line of thought and changed operations. How can you best guide your future activities to take advantage of the present circumstances?

The service and installation engineer is expected to do a herculean job in maintaining existing equipment. These and other problems will be discussed at the 8th Annual Convention of the Refrigeration Service Engineers Society, and your attendance should be judged on the basis of a good business investment, whether you operate your own business or are employed in the service and installations department of a dealer, distributor, or contractor. The information you will secure will be equally beneficial to yourself and to your employer.

The 8th Annual Convention of the R.S.E.S. provides the best opportunity of getting first-hand information from the manufacturers who are fabricating parts and supplies that you use in your daily work. At this exhibition you will get first-hand information as to what methods the manufacturers are employing to maintain a flow of as much material as possible for service and replacement work.

The Convention Program

One of the outstanding events of the year is the Annual R.S.E.S. Educational Program. This year, the theme will carry out

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the idea of how best the service and installation engineer can perform his business in view of existing conditions. The subjects which the Program Committee is now determining will be assigned to outstanding speakers, who are qualified by training and experience to authoritatively discuss the subjects assigned to them. As usual, the program will be so designed as to be concise, interesting and informative. The meetings

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will be confined to the mornings of the first three days of the All-Industry Exhibition, allowing ample opportunity for a careful inspection of the exhibits.

Surpassing in size and number of exhibits any preceding refrigeration exhibition, the All-Industry Refrigeration and Air Conditioning Exhibit will present the largest array

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of refrigeration equipment parts and accessories ever assembled under one roof. The exhibition, in itself, represents one of the finest educational features to be seen. The large exhibition hall of the Stevens Hotel—the largest hotel exhibit hall in the country—plus the mezzanine, will bring the nation's leading refrigeration equipment manufacturers to you. Some idea of the extent of the exhibit may be gained from the list of exhibitors who have already reserved space.

"Extree"—Added Attraction
The Antequarium

A new section of the exhibition—under the title, "The Antequarium"—will contain two distinct types of exhibits. One will be made up of technical displays by Government agencies interested in refrigeration and air conditioning, who are in a position to take part in it—such as the U. S. Patent Office, Bureau of Standards, Department of Agriculture, and so forth. The other type will be composed of early-day models of present-day products of the exhibitor firms. As complete a line of ancient types of compressors, expansion valves, coils, controls, fittings, and so forth, is being assembled, together with collections of early-day manufacturers' catalogs, sales literature, advertisements, and early issues of leading trade papers will be on display.

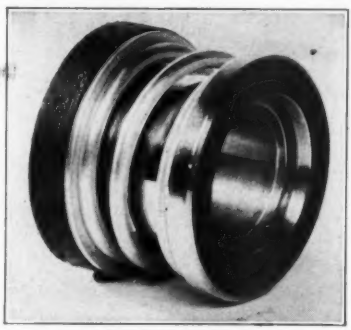
ARE YOUR DUES PAID?

Have You Misplaced Your Invoice?

Don't let your membership lapse. Check now and see that your current 1941-1942 dues are paid. Oftentimes in the rush of business you may have misplaced your invoice for dues. The surest way to see that there is no interruption in your mailings is to check up on your 1941-1942 dues.

WISCONSIN STATE PICNIC

PLANS are now complete for the Wisconsin State picnic to be held Sunday, September 14, at Tenney Park, Madison, Wisconsin.



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what air-conditioning is, what it can do, its technical fundamentals, the methods of applying them, and the many types of equipment available and how they work.

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The gathering will start at 10:00 a.m. and the day will be occupied with baseball and other games, contests and races for the children, and a general good time. Those attending are requested to bring a basket lunch to take care of their families or groups. Coffee, pop, and ice cream will be served on the grounds.

It is expected there will be an attendance from all sections of Wisconsin and Northern Illinois, and the committee extends an invitation to everyone to come and join in the fun.

Coming Conventions

ILLINOIS STATE ASSOCIATION
October 18-19, Leland Hotel, Aurora

THE 4th annual convention of the Illinois State Association will follow the procedure of past state meetings, in providing for interesting educational programs at both days' sessions. The annual banquet will be held on the evening of the first day. Committees are actively engaged in completing final details.

All service engineers, whether members or not, are cordially invited to attend the State Association meeting, but those servicemen especially in the Illinois area are urged to make arrangements to attend this meeting on Saturday and Sunday, October 18 and 19. Subjects of pertinent interest to all service and installation contractors will be discussed.

NEW YORK STATE ASSOCIATION
October 23-24, Hotel Aster New York City

FINAL arrangements are being completed for the second annual convention of the New York State Association meeting. Present-day problems make it necessary for the service engineer to keep informed on current developments as they affect the operation of his business. The New York State Association meeting provides an excellent opportunity for service and installation contractors located in the states of New York, New Jersey, Pennsylvania, and Massachusetts to attend this important two-day conference on October 23 and 24. The annual banquet of the Association will be held on October 23, and committees in charge of the

arrangements include Ernest E. Condon, Flushing, N. Y., *General Chairman;* Eugene Phillips, Rockaway Beach, N. Y., *Entertainment Chairman;* George B. Gardner, Schenectady, N.Y., *Educational Chairman;* Ralph Davis, Buffalo, N. Y., S. Szyszkowski, Buffalo, N.Y., John K. Bush, Buffalo, N. Y., *Publicity and Advertising Committee;* Mrs. W. Andrews, Syracuse, N.Y., *Ladies' Entertainment Chairman.*

Additional information can be secured from John K. Bush, President of the New York State Association, 715 Elmwood Avenue, Buffalo, New York.

R.S.E.S. ANNUAL CONVENTION Jan. 12-15, 1942, Chicago, Ill.

THE 8th annual convention R.S.E.S will be held in conjunction with the All-Industry Refrigeration and Air Conditioning Exhibition, Chicago, January 12-15.

R.S.E.S. Chapter Notes

PITTSBURGH CHAPTER

The annual steak fry of the Chapter was held during July at Cooper Rock in Morgantown, W. Va. There were twenty-five in attendance, and everyone had a swell time, as well as plenty to eat. Mr. and Mrs. Guy Croston were the host and hostess at the outing, and the thanks of the entire attendance are extended to them for an enjoyable time.

CENTRAL ARIZONA CHAPTER

August 22—This was intended to be the annual meeting of the chapter; however, most of the members were apparently too busy to attend, and a quorum was not present. The election of officers, therefore, was postponed until a future meeting. Dues were collected and a general round-table discussion occupied the greater part of the evening.

ROCKFORD CHAPTER

August 4—Most of the evening was devoted to business matters of the Chapter. However, during general discussions, it was suggested by the President that a Hallowe-en dance be planned at this time. Every one seemed in favor of the idea, but plans were tabled until a future meeting.

August 18—Further plans were made for the Halloween dance, and it was suggested that it be made a masquerade. A prize will

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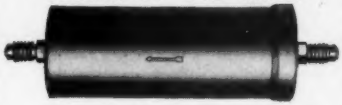

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be offered for the best-dressed person, and a committee was appointed to make all arrangements.

The attendance drawing was held at this time, and because the member whose name was drawn was not present, and because this was the third consecutive meeting at which the prize had been held over, a second drawing was made, and Henry Genin received $3.80, which was the total amount of the prize. The rest of the evening was spent in business matters of the chapter.

AIR CONDITIONING TO INCREASE COPPER PRODUCTION

IN order to increase America's supply of copper urgently needed in national defense work, the Magma Copper Company has just installed three new 140-ton centrifugal machines to provide air conditioning down to the 4,600 foot levels of its mine in Superior, Arizona, according to Edward T. Murphy, vice president in charge of marketing, Carrier Corporation, Syracuse, N. Y.

This marks the third extension to the original air conditioning system which was designed and engineered by Dr. Willis H. Carrier in 1937. At the time, the Magma Copper Mine was the first mechanically air conditioned mine in the United States.

According to Mr. Murphy, air conditioning the deep shaft to the 4,600 foot level is expected to increase the mine's capacity by deeper mining.

Unusually high rock temperatures have made air conditioning necessary in the Magma mine. Temperatures range from 127 degrees on the 3,200 foot level to 150 degrees on the 4,600 foot level. This new installation is expected to cut temperatures down to 90 degrees at the deepest workings.

FEDERAL EXCISE TAX PAYMENTS

CERTAIN misunderstandings seem to exist among Federal Excise Tax deputy collectors' interpretations of the tax laws. Some deputies, apparently, insist that automatic and thermostatic expansion valves

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should be classed as expansion units, or evaporators, and taxed as one of the six components.

The six components are condensers, compressors, controls, cabinets, evaporators, and absorbers. The last item, absorbers, seems to be an unknown piece of equipment in the electric refrigeration field, and even Washington is unable to provide information on what absorbers are. Recently, a deputy endeavored to tax dryers under the heading of "absorbers," claiming they are absorption units. Driers, however, are definitely not a component part, and are not taxable.

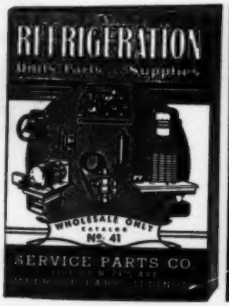
Refrigeration Service, Inc., Los Angeles, Calif., received a letter from Washington, dated July 14, which stated: "Since automatic and thermostatic expansion valves are held to be expansion unit parts or accessories and not refrigerator components, it follows that no tax under the provisions of section 3405 of the Internal Revenue Code attaches with respect to the manufacturer's sale of such articles, if made separately."

Expansion valves, therefore, can only be taxed as a part of a complete installation when everything has to be listed. If they are sold separately as a replacement, they cannot be taxed.

NEW BONNEY BOX WRENCH SET

A NEW set of box wrenches with double hexagon openings and heads placed at 15° angles has just been announced by Bonney Forge & Tool Works, Allentown, Pa.

Known as the No. 36 Set, it contains two short type and four long type wrenches, each with a different size opening in each end. They are drop-forged of Bonaloy



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Steel, carefully heat-treated, fully chrome-plated and have polished heads.

They are especially adapted to all production and service work with low overhead clearance, and either side of the head may be applied to the nut or bolt. Openings included in the short type wrenches are 3/8 and 7/16 inch, and 1/2 and 9/16 inch. In the long type wrenches the following openings are included—3/8 and 7/16 inch; 1/2 and 9/16 inch; 5/8 and 11/16 inch; and 3/4 and 13/16 inch.

For convenience in keeping together all wrenches in the set, they are furnished in a durable, leatherette roll with an individual pocket for each wrench.

Full information will gladly be supplied by the manufacturer.

NEW CATALOGS AND BULLETINS

CARRIER CORP., Syracuse, N. Y. "Heat Disposal" is the title of a 12-page booklet just published by the company, outlining the theory, operation and principal features of the complete line of Carrier Evaporative Condensers.

Replete with diagrammatic drawings and photographs, the booklet explains in detail the methods of heat disposal from both air conditioning and refrigeration and from liquids and engine jacket water.

One section of the publication is devoted to horizontal, suspended-type evaporative condensers, while another deals with vertical, floor-mounted types. Large tonnage capacity evaporative condensers, ranging from 10 tons up, are included in a third section of the booklet.

A two-page spread of typical installations of evaporative condensers in large and small establishments throughout the United States portrays how savings in operating costs have been effected through consumption of less water, less electrical power and lower pumping costs.

THERMAL COMPANY, INC., St. Paul, Minn., and Milwaukee, Wis., released their first issue of "Thermal-Gram" during August. The paper, devoted to "messages from Thermal Company, Inc.," contains news items of general interest, observations, and catalog supplementary information.

Huntington W. Small is president of the Thermal Company, who are jobbers of refrigeration replacement parts, tools, and equipment. The company operates two warehouses, one in St. Paul, Minn., and another in Milwaukee, Wis.